THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE ELECTRIC LIGHTING OF VILLAGES.

WE have for a long time taken a keen interest in the extension of electric lighting to small towns and villages, and have on various occasions drawn attention to the possibilities in this direction, besides publishing descriptions of actual installations whenever the opportunity offered. Since the introduction of the high-voltage metallic-filament lamp the matter has gained very greatly in importance, for obvious reasons, and the gradual relaxation of the dislike evinced by the Board of Trade for overhead wires, as well as of the opposition of the small local authorities, has facilitated the execution of the work on a commercially satisfactory basis. We therefore welcome the article on this subject, written at our request by Mr. W. T. Wardale, which appears elsewhere in this issue, and we commend it to our readers as a remarkably interesting and useful exposition of the methods which ought to be adopted, and the considerations which must be borne in mind by those who contemplate the cultivation of this almost virgin field of operations.

The author points out that such schemes—if properly carried out—are financially sound, and that private enterprise is in a more favourable position to deal with them than the local authority, which is hampered by statutory obligations to a degree inversely proportional to its own importance; moreover, owing to the impossibility of paying an adequate salary to a competent engineer, such an authority could not hope to run the concern on the same economical basis as a private company, which can handle a number of these small undertakings, and thus distribute the cost of superintendence over a large area.

Another point to which our contributor draws attention is that it is absolutely essential for the promoters of the undertaking to carry on the business in its entirety—wiring houses, selling fittings, &c., and even undertaking work in connection with private installations that have no connection with their mains. We know for a fact that such work, under the circumstances, is very lucrative, and we can well believe that its performance makes all the difference between success and failure, while it would be out of the question for a small municipality to handle it.

The shrewd remarks of Mr. Wardale regarding the desirability—indeed, the necessity—of engaging the interest and influence of the local notabilities will be appreciated, and his warning against rash conclusions with regard to the utility of small water-powers should be heeded: for intermittent operations like those of a sawmill or flour mill, such water-power is often perfectly suitable, but where a continuous supply of power is indispensable, as in the case of electricity supply, an independent source of power must usually be installed, and the resultant cost may prove to be much greater than that of a complete steam or gas-engine installation.

The fact that competition has not to be feared in connection with these small undertakings is a feature of great value; the residents are eager to have a supply of electricity, and are willing to pay a fair price for the convenience and safety of the system. They are also well acquainted with each other's doings, and the spirit of emulation which prevails in a small community ensures that the example set by

one consumer will be quickly followed by his neighbours. The truth of this is clearly manifested by the statement that in practice no difficulty is experienced in inducing people to install the electric light.

While continuity of supply is very desirable, it has not the same pre-eminent importance in a rural district as in towns where competition is met with, and, in view of the necessity of keeping down the capital outlay, there is no need or justification for the provision of a large proportion of stand-by plant. We fully agree with Mr. Wardale that there is no better reserve under the circumstances than a storage battery, in conjunction with generating plant of a thoroughly reliable description. The battery also facilitates the economical working of the undertaking to a very great extent, and the objections to the use of storage which have weight in the case of a large undertaking are absent from village lighting.

The importance of the personal element is obvious; the man in charge on the spot is largely responsible for the success or failure of the whole scheme, and it is impossible to be too careful in the selection of a suitable person. Fortunately, the work is of an exceptionally attractive nature, and if generous terms are offered, there should be no difficulty in getting a first-class man to throw his whole energy into the business. There are thousands of British villages waiting to be supplied with electricity, and we look forward to the development of this class of business at a rapid rate during the next few years.

L.G.B. Procedure.

One of those irritating points of procedure which are so frequently met with in connection with Government offices, was recently raised by an Auditor of the Local Government Board in connection with the accounts of a municipal electricity department. The auditor, while finding no fault with the accounts, laid down the requirement that in future all orders for goods required in the electricity department must be signed by the Clerk to the Council; for years previously they had been signed by the manager, after having been submitted in the form of a requisition to the Stores Committee, and no trouble had arisen. We believe that it is the usual practice for the manager (*i.e.*, the electrical engineer) to sign all such orders below a limit of value imposed by the Council, and we see no reason whatever for objecting to this procedure; the signature of the Clerk to the Council would be a mere formality, for the Clerk could not possibly exercise any discrimination in the matter, being neither technically qualified to do so nor officially authorised to supervise the decisions of the Stores Committee and the electrical engineer. Nor would he be in a position to check the delivery and consumption of the goods, even if he wished to overstep the bounds of his duties to such an extent—which is in the last degree improbable. We see in this new stipulation neither sense nor reason; it could only result in an apparent subordination of the engineer to the clerk, with the inevitable consequences of friction and irritation between two otherwise friendly departments. Perhaps some of our central-station readers would like to express their views on this question before the L.G.B. has committed itself definitely to an undesirable policy.

The "Paragon" Oil Engine.

The ingenious cycle devised by Mr. W. P. Durtnall, of which we give a description elsewhere in this issue, shows that there is still scope for invention, even where the ground has been so well trodden. Even if the over-all efficiency of the engine were not increased, the advantage of a cool and noiseless exhaust would be worth having, but the inventor claims a thermal efficiency from 15 to 25 per cent. greater than that of the ordinary type of engine. That a greater proportion of the heat contained in the products of combustion will be converted into work by virtue of their complete expansion is obvious, but whether the over-all efficiency of the engine will be materially improved appears to be less certain. In this connection, we find Mr. Durtnall's comparison of his indicator diagram with that of a Diesel engine rather incomplete, for while he points out that the compression space in the latter type would be twice as great [with the same length of stroke] as in the case of the Paragon cycle, he does not explain that the expansion curve of the Diesel would be higher than that of the Paragon diagram; the compression curve would also be higher, but the net result would be a greater output from a given cylinder, and probably a higher mechanical efficiency, although the consumption of fuel would be greater. With the small compression space of the Paragon engine, the amount of fuel oil that can be completely burnt would appear to be restricted, so that a cylinder of given size could not have the same output as a Diesel cylinder. The inventor states, however, that the weight of his two-cycle engine for a given output is lower than that of most engines that are on the market, and it would be interesting to have from him a more detailed comparison between the old and the new system, throwing light on the points mentioned above.

As regards the cushioning action claimed for the Paragon four-cycle engine, we may point out that this only occurs in every second revolution, and is therefore not so effective as would appear at first sight.

Apart from these minor points, however, the new cycle is certainly interesting; we understand that Paragon engines of considerable power are under construction, and we shall be glad to receive particulars of the results obtained in actual working.

The Fire Risk.

The regrettable fire which recently shut down Salford's electricity supply, following as it did closely on other occurrences of a similar nature, both in this country and abroad, raises a question of considerable moment to electricity supply authorities.

Every business depends more or less on the goodwill of its customers, and electricity supply being a highly competitive business—despite all assertions to the contrary—its dependence on the goodwill of the consumer is absolute.

The consumers really rule the roost, and the collective impression left upon their minds dominates the future of supply work. Whether the impression left by the happenings of the last few weeks will be good or bad, we can safely leave our central-station friends to decide; many of them would barter their souls to ensure continuity of supply, and it is therefore not difficult to estimate their feelings in the matter. One thing is certain: the time has arrived when means must be found for safeguarding the supply generally, and ensuring beyond doubt adequate illumination for the time being of the streets, hospitals, large emporia, theatres, &c., even if a switchboard fire, as at Salford, or a faulty machine, as at Sheffield recently, does cause a temporary shut-down at the generating station.

For some purposes electricity is indispensable, but for a great many of its applications the advantages which have served to popularise its use are not such as entirely to outweigh a general, even though unjustified, impression of unreliability gathered from reading the daily newspapers. We do not wish to create an erroneous impression; complete and even partial shut-downs of electrical stations, considering the total number of plants involved and the years they have been running, are comparatively insignificant in extent—but unfortunately the consumer is unaware of this, and his tabloid news summary is apt to produce an exaggerated idea of the trouble. It is for the central station engineer to appraise the pecuniary value of reliability; our own impression is that any means which will ensure that public lighting, for instance, is not wholly dependent on the perfection of the mechanical, electrical, and human agencies at the power station, is well worth paying handsomely for.

The battery sub-station for special services, for both D.C. and A.C. supply, merits more attention than it has received, and even central-station arrangements are capable of improvement, assuming, of course, that some sacrifice in other ways is justified on the score of reliability.

THE ELECTRIC LIGHTING OF VILLAGES.

By W. T. WARDALE, A.M.I.E.E.

It is very generally assumed that the electric lighting of country villages, otherwise than from the mains of a large power company whose lines cross the district, or by the plant at a local colliery or other large works, will not pay its way. This opinion, however, is not correct, and provided that the plant is carefully laid out to suit the local conditions, with the capital outlay kept rigorously low, village electric lighting schemes can and do pay their way. For some time past the writer has been interested in such small schemes, and from experiences and results gathered from several such plants, offers the following suggestions as to the lines on which such schemes should be run.

In the first place, it should be recognised that a company can be formed to carry out the work for a considerably less outlay of money than the local governing authority, and for that reason the scheme should, at any rate, be started and established by a small company which must have the active sympathy and encouragement of the local council. The reason for this state of affairs is that whilst a small company having the goodwill of the council can start a supply without an order, and without other expensive preliminary outlays on sanctions and permissions, the local authority must have these inquiries, and on such small jobs they increase the capital expenditure to such an extent that the concern cannot make ends meet. A company, however, should never be formed or start working without an agreement in writing with the local council that the said council will encourage and protect the enterprise of the promoters. If this is not done, then the writer can state from actually being in touch with people whose enterprise has been simply ruined by the iniquitous policy of the local governing body, that the gravest possible risks may have to be encountered. The best course is to get the leading local men and the Council in favour of the scheme. This may be accomplished either by means of private conversations or by arranging a public meeting with an influential local chairman and strong local support, and explaining the advantages of electricity as a means of lighting, heating, cooking, and also as a handy method of working farm, garden, or water supply machinery. Many of the larger houses have plants for lighting by acetylene or petrol gas systems. At the suggested meeting it should be explained that electricity in the home does not involve trouble with burners and pipes which corrode, or if oil lamps are used, it should be pointed out that the labour of servants in trimming such lamps will be saved. At such a meeting it should be possible to enlist financial support from some of the most influential men in the district, and this accomplished, the progress of the concern will, as a rule, be very smooth. This part of the matter has been treated at length, owing to the fact that the writer knows from experience that it is the neglect of these points which generally lands the concern in financial straits.

The goodwill of the Council having been obtained, the necessary capital should then be decided on, and this will be settled by the size of the localities to be supplied. In a locality of from 800 to 1,000 inhabitants, a start can be made with a generating plant of 10 KW. and a battery of 300 ampere-hours, supplying through overhead mains, for an outlay of less than £500. This figure will vary locally to some extent, owing to the cost of obtaining the necessary site and a suitable building in which to house the plant. In one case at least the writer knows of a plant which has started up and run successfully on a less outlay than £500. In drawing up the company's articles, it should, however, always be stated that the company is entitled to raise a capital of at least £1,000 to £2,000. The whole of the capital need not be issued at first, but it will be required when the company has been established a couple of years, and on such small schemes bank interest on loans, and the usual worrying of the bank to have the company's debit account reduced, are extremely trying. Another point to be included in the articles of association, is that the company is authorised to generate and supply electric energy in the districts of X.Y.Z. and elsewhere; this point allows the company to extend its operations to other districts which promise a return on capital spent. One point is absolutely essential if the company is to pay, and that is that the company is empowered not only to generate and supply electricity, but also to carry on the business of wiring contractors, to deal in and sell fittings and lamps, motors, heaters and cookers, and every electrical appliance. Power should be claimed under the wiring contractor clause to fit up and keep in repair installations at private country seats, as many places too far from the mains will be glad of the services of a competent engineer near at hand. The reason for the wide scope which it is advised to take, is that experience shows that the hours of running in such small plants are so short, and the revenue at first from electricity supply so small, that the cost for attendance would be prohibitive if men were employed on station work alone. Also, it must be remembered, that there is in such small localities, no chance for a resident wiring contractor to make a good living apart from an electricity supply; therefore, if all wiring has to be done by firms sending men from the nearest town, the cost of installing the light would be unnecessarily high, and would thus retard progress.

Overhead mains must, in the majority of places, be used if the concern is to pay, and it is fortunate that to-day there is little objection to them in country places. Another mistake to be avoided, is the use of the three-wire system. Certainly, the writer knows of a village plant which is run successfully with the three-wire system and underground mains, but there are reasons in this case which do not obtain in the usual village; and though the place pays, yet it would naturally pay better with the simpler system. In choosing the site for the generating station, the usual features of nearness to the railway or river, and a plentiful supply of water, should not be overlooked, whilst the roads to the site should be inspected with more than usual care. This latter may seem an obvious point, but it is often overlooked; and in country places the difficulty of getting stuff on to and away from the works may easily be serious. Again, do not assume because there is a supply of water running through or by the site, that the purchase of the site also carries the right to free and full use of the water; the writer has known more than one or two plants let in for quite unexpected rent charges over this point. Perhaps the site which has to be looked on with the greatest amount of suspicion is that of an old water mill, having the apparent advantages of a weir ready made and the water rights. This sort of place should be most carefully inspected, the points to be noted being whether the dam is in good working order, and what is the amount of power which can be depended on throughout the year, when, either due to shortage of water in very hot summers or to heavy floods at any time of the year, the power available is at its lowest. Neglect to note these points has led small village concerns into purchasing an old water mill at a fair price, and then finding out that the necessary repairs to the dam, alterations to the wheel, and awkwardness of the site in regard to the rail and main roads, have so increased the capital cost that the company has never really been able to pay its way, especially as often an oil engine has to be installed ready to take the load when the water-power is not available, due to either floods or shortness of water. The matter of purchasing or leasing the site must be settled locally; perhaps one of the best methods is a 42 years' lease.

The site and system having been settled, the next consideration is the purchase of the generating plant, and in this matter, as in all others connected with village lighting, capital must be kept low. If there is no system of lighting in the locality, except by oil lamps or private lighting plants, a high price per unit can be obtained, and the locality still be benefited by using the electric light. The following investigation carried out some years ago by the writer whilst on the staff of the electricity works in a cathedral city will show the cost under careful use, of lighting by oil lamps a six-roomed house. The house, though near the main road, had neither wiring nor gas pipes laid, so the lighting was carried out as follows: The second room being the living room was lighted by a swinging lamp suspended from the centre of the room and about 3 ft. 6 in. above the table; this gave a nice soft light to work by on the table or to read by at the fireside, the lamp giving about 30 C.P. As a means of obtaining information, as well as keeping the cost down,

the cost and results were carefully noted. A smaller lamp which rested on the kitchen mantlepiece did duty for the kitchen, and was seldom used for more than 5 or 10 minutes at a time ; this and a small hand lamp used for upstairs work comprised the lighting apparatus of the house. In winter it was just possible by very careful use to keep the necessary light going on 1 gallon of paraffin, costing 8d., whilst there was also an expenditure of, say, 2d. for candles, making the weekly lighting bill under the most careful management possible, about 10d. In summer this charge came to 6d. one week and 4d. the next week for oil, so that the average charge was 5d. Taking current at 7d. per unit and a good class metallic-filament lamp of 35-c.p. in the living room and a 20-c.p. lamp in the kitchen, each lamp taking 1·3 watts per candle, the living room lamp could be used for 40 hours and the kitchen lamp for 10 hours per week at a cost for current for 1s. 2d. This, of course, involves careful use of the light, but the writer ventures to say that few people would have run the oil lamps in the same house under that charge. The cost of the electric light can be kept down by switching out for a few minutes when the light is not wanted, a thing which is impossible with oil lighting ; also, there is the fact to be considered that the tenant had to do the inside painting and decorating, which item would be much less with electric than with oil or gas lighting, whilst the time saved in doing the necessary trimming to the oil lamp is no small item. Thus, with current at so high a price as 7d. per unit, electric light becomes very attractive. Under such circumstances the generating plant will not need to be of superlative efficiency, but it must be absolutely reliable. It will be apparent that in any place where capital is not too easily raised, and where a fairly early promise of a return must be shown in order to encourage the shareholders, the policy is to keep down the cost of the generating plant, preferring a plant having only moderate economy but low in cost, to one which gives the best possible economy but takes so much of the capital that little is left for development. Many really good second hand plants can be bought for such places at very cheap prices, providing that the buying is done by an engineer, as if a person not an engineer buys such plant there is very grave risk of him getting a very poor bargain.

Concerning the type of plant to be used, this matter will, to a large extent, be settled by the price of coal locally. Where coal can be obtained for 10s. a ton or less, the claims of the self-contained steam plant should always be considered. Even with the most heavy drawbacks, such as working non-condensing, and with cold feed-water, such plants can, where prices as high as 7d. and 8d. per unit can be obtained, pay for their use, and as they can be obtained second-hand for less than half the capital cost of new plant, it is policy in such places to use this type of plant and spend the capital so saved on the development of the load by running extra feeder and service lines. In fact, the writer knows of places where the scheme would have never paid quickly enough to encourage further capital if this policy had not been adopted. When the concern is well on its feet, then capital can be spent in buying the more efficient types of plant for extensions, being more easily obtainable then. Where capital is not too tight and in too great a hurry for its first return, then the best and most efficient type of plant to put down in any concern needing sets of less capacity than 15 kw. at the start, is the internal-combustion engine ; but where the first sets installed are of 15 kw. or more, and coal for steam plant can be obtained at 15s. per ton or less, the over-type superheated steam engine, as made by Messrs. Garrett, of Leiston, should be considered. When a good supply of condensing water and water of good quality for boiler feed is available at a reasonable rate, then this engine gives highly economical results, added to which is the certainty of operation which is the distinctive feature of steam plants, and also the fact that these plants have a high overload capacity, which reduces their capital cost per horse-power actually obtainable to a very low figure. The stand-by losses on such a plant are greater than on the suction-gas engine plant, but they need not be excessive if the furnace door and ashpit are fitted with airtight covers to be put on at shutting down, and the chimney damper and engine and boiler lagging kept in good condition. The inquiries for prime movers should, however, always include three or four different types of internal combustion engines. The deciding factor in most cases will be the cost of suitable fuel for the suction gas plant, or for the crude oil engine. Although the suction gas plant can now be made to use bituminous coal to some extent, the writer prefers to use this type of plant on anthracite, for the following reasons. Anthracite is the cleanest fuel to use, and in spite of all statements to the contrary, the suction or pressure producer working on ordinary coal has always the risk of sending tar over to the engine, and, in any case, needs the engine to be taken down oftener for cleaning of the cylinder liner, piston and valves, than when anthracite is used. There is also the fact that as the tar, which is a valuable heat-containing constituent, has to be taken out of the gas in order to ensure successful working, the amount of coal used per unit is considerably higher than when anthracite is used ; hence the lower price for the bituminous coal does not give all the economy which at first is suggested. The gas engine working on a suction producer is, when properly installed, a most reliable prime mover, and if when buying the producer it is specified that the producer shall generate sufficient steam itself to make the use of anthracite peas practical and sure, it will be generally found that the anthracite scheme is in every way the more attractive. It should always be borne in mind in comparing the two types of producer, that not all bituminous coals are safe to use for producer and gas engine work, and that the field to be selected from is not as wide as it appears to be.

In considering the crude-oil engines, whether of the Diesel or semi-Diesel type, two points must always be borne in mind. One, and a most important one, is that the control of the necessary fuel is in the hands of one or two people, the supply at present is strictly limited, and the price has risen very greatly during the past year, and shows signs of still further increase. The other point applies more to the Diesel than to the semi-Diesel engine, and is that this engine cannot be attended to successfully by an ordinary type of engine attendant, thus the wages cost will be increased to some extent ; whilst recent happenings have shown that the Diesel has problems of its own in connection with the matter of safe working, causing rates for insurance to be higher than with gas-engine plant. If it were not for the uncertainty of the future of the oil market, the crude oil engine, working on the semi-Diesel principle, would be ideal for the purpose of village lighting plants, there being no stand-by losses and no producer house necessary. The whole matter must be carefully summed up with regard to local circumstances. With any producer-gas engine installation, the effluent from the producers must not be turned into a clear stream ; it should be either led into the ashes and clinker, and sent away with them, or should be loosed into the stream when the same is in flood ; the stuff is then in so small a proportion to the amount of water in the stream, and so quickly swept away, that no damage will result. With every type of internal-combustion engine, the great point is to buy it large enough for its work. The Institution of Mechanical Engineers' Gas Engine Investigation Committee recommended that, for continuous working loads, a gas or oil engine should be purchased at 15 per cent. above the makers' rated load—that is, if a 20-h.p. load is needed continuously, then select an engine giving, according to the makers' rating, 23 h.p. at the least. This will increase the capital cost, but is the only safe way of ensuring satisfaction. Several of these small village plants with which the writer is in touch are run with suction-gas engines, and the owners speak uniformly well of their performance over periods of five years or more. In any such installation do not overlook the fact that the exhaust silencing arrangements must be more than usually ample.

With every such plant as we are considering, a 24-hour per day continuous supply is contemplated, and for this purpose, and for the economical working of the load, a battery is indispensable. In putting in a battery, the mistake to be avoided is that of installing one so small as to be useless in about two years. Along with the question of the battery must be settled the voltage of supply. Some plants are supplying at 100 volts, but the majority of these places would, if possible, change over to a higher voltage now that the metallic lamp is available at pressures as high as 230 volts. This pressure is about as convenient a pressure for

all-round considerations as any; the generator should be capable of giving 245 volts, as this allows for drop on a possibly heavily-loaded mains system, and gives some amount of room in which to control the station voltage. It is not advisable to work the battery down to 1·8 volts per cell, and a battery of 125 cells will give the necessary 230 volts without getting down to the 1·8 limit, and will allow four regulating cells. A good idea of the size of battery to install is to put in, for an installation starting with a 10-KW. set, a battery capable of giving 30 amperes for three hours. Such a size of battery will allow the load in the very early days of the supply to be carried by the engine running, at the most, on four days per week; this feature helps matters considerably, by allowing the greater part of the time of the man in charge to be devoted to getting consumers connected up, whilst, when the load increases to such an extent that the engine must be run every evening, the battery is a good stand-by, and assists economical working. It will, of course, be understood that the three-hour rate of the battery means that it will be able to give a discharge of seven or eight amperes for 20 hours.

The switchboard should be as simple as possible, the number of instruments being as few as will conveniently work the board; in some cases the use of an automatic battery regulator allows the plant to be left to a considerable extent and has been found to give no trouble or risk over a long period.

The cable system should, in the majority of cases, be on the overhead bare-wire system; both copper and aluminium have been found to give satisfaction. The question of way-leaves over land belonging to various people must be settled by a personal and tactful interview, and to-day permission is rarely refused; needless to say the overhead line, when erected, should be as neat a job as possible and not offensive to the eye; special wire, fittings and insulators are now produced for this work in large quantity, and an example of the stuff used will be given. The services are often taken in through the window frames, and here in particular the neatness of the work will do much to remove any natural prejudices against overhead lines.

On the question of charging, by meter or by contract, it is found that experience and opinions differ; at least one very successful plant prefers the use of meters, and finds them economical and efficient, this installation serving a population of only 800 people. The majority, however, prefer the contract system of payment, and do their utmost to encourage it by quoting favourable rates.

No difficulty is experienced in getting consumers to come on, the obvious advantages of the electric light bringing requests for connection as fast as they can be dealt with; positively every place with which the writer is in touch tells the same story—"We do not find it necessary to offer any special inducement to get people to put in the light." Most places find that a very satisfactory job can be put in for 12s. to 14s. per point, this being done in wood casing and including a plain fitting and metallic-filament lamp; some places find for works and other than house lighting that twin lead-covered rubber gives a serviceable installation at rather less cost. All concerns agree that a cheaper system would be welcome to some extent, and most of them prefer not to use slip-joint conduit, although it is cheaper than most present systems.

A point of the utmost importance in such places is the arrangement of the men to work the place. The man chosen to take the lead is often a local man having a good training in running such small plants, and in the proper wiring of premises. Many such men are to be found who have obtained their experience mostly in the running of country house plants, and in wiring the same. It might be thought that sufficient money could not be offered to attract any but the man looking for experience. This mistake, however, arises from the fact that the wiring side of the business is left out of the reckoning; on the generating side alone the money cannot be provided, but when it is realised how very little the up-to-date small plant requires in the way of attention, and that the salary is earned on the installation side as well, the matter becomes plain. Some companies find that they prefer to pay a regular salary, increasing with the number of units generated, and a salary as manager of the wiring department; others pay a contract price per unit generated to the responsible man, and find that it pays both them and him; he also has the proportion of the profits due to him as manager of the installation work. The combined salary is in most cases one which many chief assistants in towns having a population of 50,000 inhabitants would be glad to earn, whilst the position allows most valuable experience to be gained; the secretarial work is generally carried out in the office of a local solicitor having an interest in the company.

A brief mention of one or two plants will be of value in showing what is actually being carried out.

The Caergwrle and District Electricity Supply Co., Ltd., supplies the village of Caergwrle, near Wrexham, the population being 800. The supply is at 100 volts, two-wire. A simple Davey-Paxman under-type steam plant is used, which works to atmosphere and on cold feed. Two Johnson & Phillips dynamos of 7 KW. and 3·8 KW. respectively, and a 200 ampere-hour Chloride battery comprise the plant. The mains are of bare copper run overhead on wooden poles. The company has no provisional order, but its relations with the Parish Council are very good; the matter of the company doing the street lighting is at present under consideration, and should the Council decide to take over the concern, it will be on terms fair to both parties. The company was started by a few local public spirited gentlemen, and it is encouraging to know that they declare the financial result to be decidedly satisfactory. The price charged is 8d. per unit, and consumers are coming on faster than they can be dealt with. The mains system is interesting, and will be briefly described.

Wooden poles 31 or 32 ft. long × 9 in. diameter at the ground level, tapering to 7 in. at the top, are planted about 5 ft. 9 in. in the ground, at distances apart of 50 yards on straight runs. On some lengths this distance has been shortened to 40 yards to avoid causing annoyance by the poles coming in front of gates or windows. This distance is observed in the case of the main wires, which are No. 1 S.W.G., but in the case of a very light distributor of No. 11 S.W.G., the span has been lengthened to 72 yards. Each pole carries an oak cross-arm, 4 in. × 3 in. section, on which the insulators for the feeders are set 2 ft. apart. These insulators are made by the British Insulated and Helsby Cables Ltd., and are their K. 45 Indian pattern, shown in fig. 1. For services a double J insulator bolt with arms at 60°, shown in fig. 2, is used. The bolt on the

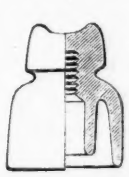


FIG. 1.

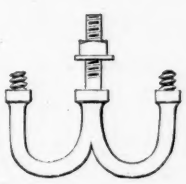


FIG. 2.

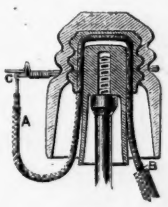


FIG. 3.

pole carries ordinary insulators, that on the houses the "Sinclair-Aitken" No. 1 pattern. This is shown in fig. 3, and is used as follows:—For a length from A to B, the lead of the twin lead-covered rubber-insulated cable is removed and the cable is pushed up into the groove as shown, the outer cover of the insulator is then put on and the service from the pole can be attached. Mr. Griffiths, the company's engineer, has adopted this method in order to get a dry patch between the bare copper at C, and the lead covering of the twin service cable, as he found that unless this precaution was taken, electrolytic action between the lead and copper corroded away some of the positive wires. Since this method has been used the trouble has vanished. The lead-covered twin service is then stapled along the house wall and taken in through the window. There is no gas supply in the village, and last year the total units generated were 5,000. Mr. Griffiths, unlike most engineers controlling small plants, prefers to use and charge by meter. The staff are paid under a contract, and find it mutually satisfactory.

Encouraged by the success of Mr. Griffiths at Caergwrle, Mr. Richard Edwards started a supply at Llanuwchllyn, near

Bala. The population is 500, the supply being at 100 volts, two-wire, mostly overhead. The plant is driven from the surplus power available from a water-wheel which works a mill. Mr. Edwards is himself an engineer and millwright, and works the lighting supply in conjunction with his other business. The surplus power available is only 4½ B.H.P., this being helped by a 200-ampere-hour battery. The price per unit sold is 5d.; the village street and library are lighted under a yearly contract, and the total output last year was 1,500 units. The capacity of the plant is about 50 units per day, and more consumers are asking to be connected than the present plant can accommodate. Mr. Edwards states that the financial result is quite satisfactory.

The supply works put down at Caldy, near West Kirby, in Cheshire, show another phase of village supply work. The "Caldy Manor Estate Co." have full charge of the development of the district, which is a high-class and somewhat exclusive residential village about three or four miles from Hoylake, the "Mecca" of English golfers, and within an hour from Liverpool. The writer has spent two summer holidays in the district, and can testify to the quiet, restful nature of the place, situated on the Dee estuary, and looking across to the Welsh mountains. As a quiet residence for a city man, the place is ideal. Gas could easily have been brought in from Hoylake, but the estate company meant to be satisfied with nothing but the best. The electric lighting plant was, therefore, put down, but although it belongs to the estate company, the accounts are kept quite separately, and the venture pays a satisfactory return on the capital invested. The capital available in this case was fairly ample, and in order that the village should not be disfigured by the electric light station, the well-known London architect, Mr. Guy Dawber, was instructed to design the generating station buildings, and the result is an admitted ornament to the district. The present population is 200; no overhead wires are used, the system being a three-wire one at 115 and 230 volts. A 32-KW. Siemens dynamo, direct driven by an 85-H.P. suction-gas engine plant, and a 540-ampere-hour Tudor battery, comprise the plant, the battery having an automatic controller fitted. The plant is at present too large for the needs of the place, but in spite of this drawback, the total generating costs, including all capital costs, come to 1·8d. per unit—a highly creditable figure. The price per unit for lighting is 6d., and for power 3d. per unit. Last year 6,100 units were sold. Here then we have a village supply in which capital has been spent freely and in order not to spoil the appearance of the district, yet which, on a very small output, pays.

At Wormit, a suburb of Dundee, the electric light is successfully competing with gas at 8s. 3d. per 1,000 cb. ft. The village has about 200 houses and 1,000 inhabitants. At present 90 of the houses are supplied, the size of house ranging from 5 to 12 rooms; wiring costs on the average about £3 10s. The generating plant is a belt-driven suction gas plant, and overhead mains are used. Most of the consumers are supplied by contract on the basis of 4d. per unit; a few of the consumers prefer to pay by meter, and for their convenience the company provides a meter when required, making the price per unit 6d. The supply is at present chiefly lighting, but arrangements are being made for a campaign to capture the cooking load which, during off-peak load hours, will be supplied at 1d. per unit. The voltage of supply is 230 with a two-wire system. The company is managed by Mr. E. A. Stewart, and was founded on a previous company; since Mr. Stewart has taken charge of matters the company has turned the corner, and it is encouraging to know that Mr. E. Stewart, the engineer to the company, is at present in Ireland carrying out the reconstruction of another similar village lighting project.

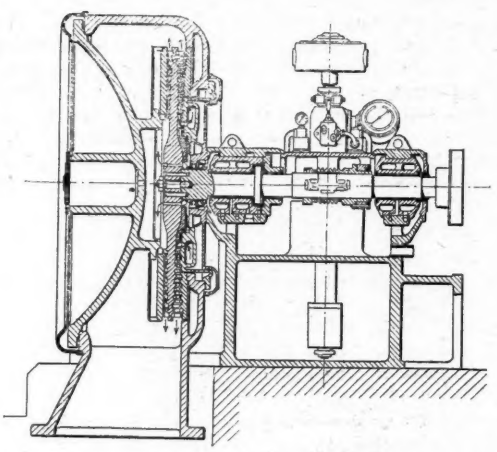
At Lyme Regis, in Dorsetshire, we have a rather larger community of 2,300 people—this size of township, however, being generally thought too small for an electric light scheme to pay. The plant here is driven by oil engines using ordinary paraffin at a cost of 6d. per gallon. This price for fuel oil is to-day very high as compared to the crude oil so much in use, but the company paid 4 per cent. in its second year. The oil engines are of Messrs. L. Gardner and Sons' make, and have given every satisfaction; they are assisted by a turbine driven from a small stream. The total cost of running and managing the place is 3d. per unit; 6d. per unit is charged for lighting and 4½d. per unit for power. Last year 26,500 units were sold. An interesting feature is that overhead aluminium mains are used—two-wire at 110 volts. There is also an agreement in force with the local authority to light the public lamps for 10 years from June 1st, 1909.

These are not by any means all the examples which could have been chosen. They have, however, been described, because they illustrate the different aspects of village lighting very clearly.

THE EYERMANN STEAM TURBINE.

[BY OUR BERLIN CORRESPONDENT.]

Though nearly all steam turbines in practical operation are worked on the axial-flow system, radial-flow turbines possess some undoubted advantages of their own. The concentric arrangement of blade rings on one disk, in fact, utilises more satisfactorily the available material, the two faces in addition to the edges being used for the arrangement of active elements. Another advantage obtained in the case of steam

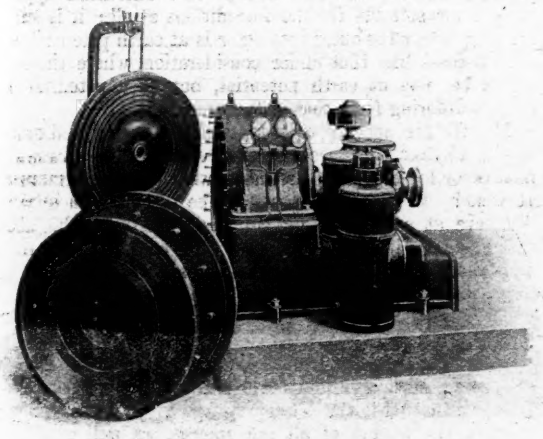


Eyermann 1,200-H.P. Radial-flow Turbine.

admission from the inside outwards is due to the increasing circumference of blading, which allows increasing cross-sections to be provided for the passage of the steam, with growing expansion. Another essential point in the economy of radial-flow turbines is a far more advantageous mode of working of the steam. In fact, in axial-flow turbines, the steam in the rotating blades is thrown outwards by centrifugal force, thus assuming higher pressures, and returns inwards in guides free from centrifugal force, which obviously impairs the efficiency of the blading. Furthermore, in any fairly long blades there are considerable differences inside and outside respectively in the average steam cross-section, as compared with the cross-section of the blade material and the peripheral speed, so that the blade angles frequently show considerable departures from the most advantageous positions. All these drawbacks are done away with in the radial-flow turbine which, on account of its homogeneous steam passages, gives rise to no harmful secondary motion of the steam.

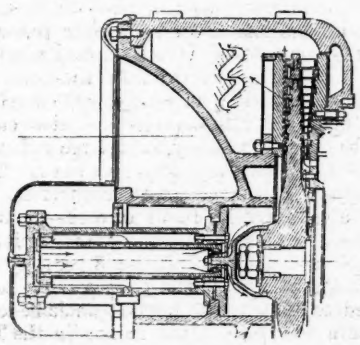
The fact that in spite of all this the axial-flow turbine has gained its present supremacy is due, on one hand, to the serious constructive difficulties offered by radial-flow turbines, and, on the other, to the prevailing opinion that one or two disks would not be sufficient for the arrangement of a sufficient number of rings of blades. This, however, is quite possible when designing the first pressure stage fairly large (*e.g.*, from 12 to 2 atmospheres abs.), the resulting speed energy being converted in one or two rotating blade rings, and the remainder of the gradient being utilised in a limited number of blade-ring pairs working on the reaction principle.

Much attention has been recently given to the radial-flow turbine designed by Mr. W. H. Eyermann, of Steglitz, Germany, which has achieved remarkable success. This turbine has its blade rings arranged concentrically on a



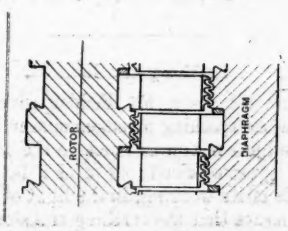
DISMANTLED TURBINE SHOWING BLADED DISK.

single disk, which, of course, involved a number of constructive difficulties. In order to reduce the weight of the rotor, such strains as would result in the disk being bent had to be balanced by counter-forces. The steam expanding on its way through the blading exerts a very



ARRANGEMENT FOR AXIAL THRUST COMPENSATION.

considerable axial pressure on the disk. This pressure is balanced by a small amount of steam expanding at the back of the disk in a number of labyrinth grooves, in a similar way to the working steam on the front side. In



SECTION SHOWING BALANCING GROOVES BEHIND DISK.

order to allow the amount of balancing steam to be adjusted, the turbine shaft is so arranged as to allow an axial displacement of about $\frac{1}{2}$ to 1 mm., thus altering the width of an annular throttling slot constituted by the stuffing box and the turbine disk, which slot is traversed by the balancing steam. Another factor liable to result in the bending of the disk is the centrifugal force of the blading arranged on one side. In order to compensate this, counter-weights, which also carry the labyrinth grooves, are arranged on the back in a similar manner to the blades provided on the front of the disk.

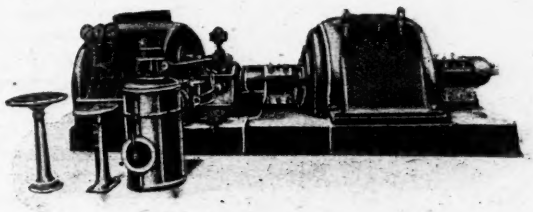
The following data relate to the steam consumption of some turbines recently constructed, as ascertained from official tests. A back-pressure turbo-dynamo of 100 KW., the exhaust steam from which is used for heating, gave the following data :—

Output eff. H.P.	Admission pressure, lb. Atmos. abs.	Admission temperature °C.	Back pressure, lb. Atmos. abs.	Steam consumption kg./eff. H.P.-hour.
150	9·24	305	1·01	12·5
112	9·36	287	1·01	13·5
75	9·54	286	1·01	15·4

The 1,200-KW. (1,700-H.P.) turbine of Messrs. Gebrüder Otto, Unterboihingen, gave the following results :—

KW.	Atmos. abs.	°C.	Atmos. abs.	Kg./KW. hour
1,200	12·35	331	0·025	6·48
720	11·25	325	0·022	7·25

Turbines of up to 1,700 H.P. have so far been constructed, and there seems to be nothing to prevent the design of much larger units on the same system. The most



EYERMANN 1,200-H.P. STEAM-TURBINE SET.

stringent tests made by the foremost turbine experts have borne out the claims of the inventor, showing the superiority his turbine possesses in many respects over the axial-flow turbine.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Kelvin.

With reference to the remark made by Mr. A. P. Trotter at the Institution of Electrical Engineers, reported in your issue of the 27th Dec., may I make some comment?

Unfortunately, it is impossible to snub a Government department, or at least, it seems so—perhaps, in this case, because it is represented by such a charming man. The rebuff the Board of Trade have received to their efforts, during the past 20 years, to introduce the name Kelvin instead of KW.-hour, would have silenced any self-respecting individual, but not so the Board. They tell us that in 1882 they graciously gave us permission to use the word Kelvin, and nothing more need be said—and this in the face of Lord Kelvin's obvious disapproval.

I trust that the industry will show its officials that, when it desires a new name for anything, it is able to dictate to them, and that it has too great an appreciation of the magnificent work done by Lord Kelvin to flout his obvious wishes—wishes both relative to this particular use and, in general, to the use of a non-decimal system.

So strongly did Lord Kelvin feel about the latter, that he said at Philadelphia, in 1884, "I look upon the English system as a wickedly brain-destroying piece of bondage under which we suffer. I say this seriously; I do not think that anyone knows how seriously I speak of it."

I have previously suggested as an alternative a more logical unit, viz., 10^7 joules, but this, I think, fails to do complete justice to the clear thinker whose memory we wish to honour, although it does not flout it.

The only proper excuse for the introduction of a new

name is the saving of mental energy. No honour is conferred on Lord Kelvin by giving his name, unless this result is brought about. Particularly in the case of such a thinker as Lord Kelvin does this apply, as he, of all people, would be gratified at anything which conserves "brain."

There must be some much more appropriate unit. Do the advocates of the use of Kelvin for kilowatt-hour know that before many years have passed we shall have got so far advanced in the use of electricity, that names will have had to be found for many quantities at present not in common use, that they are willing to waste Kelvin's name upon a crude multiple, adding to instead of reducing mental effort! It is as though we had erected a statue upside down, for all who pass to scoff and jeer at.

Percy Good.

London, S.E., *January 1st*, 1913.

High-Tension D.C. in Mines.

I should like to thank the gentlemen who have written to you upon the above subject for their criticisms upon my article, and to say that I should gladly welcome any further criticism. I am preparing a paper to be read before the Western Section of the Institution of Electrical Engineers upon the subject, in which I shall be able to deal very much more fully with the whole matter than I could possibly do within the limits of the article you were good enough to print. You were very kind, indeed, to allow me so much space, seeing the demand there is for space in your columns; but as I think everyone will recognise, even that space was only sufficient to touch the fringe of the subject. As in the paper I am preparing I shall not be limited as to length, I hope to deal with the whole matter very fully. I may mention also that it was partly with the hope that some criticisms might be forthcoming in your columns, that I requested their hospitality in opening the campaign.

I may, perhaps, be allowed to say that I have no pecuniary interest whatever in the Thury system. I have been watching its development for a long time, and it has occurred to me that it would be more suitable for mines than three-phase.

I should like to deal very shortly with two points raised by Mr. Roper. He asks whether I am serious in saying that the liability to short, with three cores, is six times that with two cores. I thought I had made it clear that I referred to the case of a three-cored cable, either inside of lead casing, or armoured, or both: the armour being earthed and the neutral earthed. With that arrangement, as I understand the matter, there are three chances of shorts between the cores themselves; and there are three chances of shorts between the individual cores and the casing.

The other point I should like to deal with is the question of joint-boxes. Will Mr. Roper give the size and weight of the smallest joint-box that he would consider satisfactory for the cable supplying a coal-cutting machine, and having to be taken through a gate road, in a seam with a bad roof? The coal-cutting machine will take normally from 12 H.P. up to 30 H.P., and on occasion may take as much as 50 H.P. Gate roads are made as short as possible, but under the conditions I have in mind, there might be several joints required within the length of one gate road.

Sydney F. Walker.

Bath, *January 4th*, 1913.

I am quite unable to follow Mr. Sydney F. Walker's idea in proposing the use of the Thury D.C. series system in mines, with concentric cables.

It is true that the P.D. across each individual motor would be comparatively low, but the same would not apply to the P.D. between the whole motor and earth, which would depend upon what part of the circuit the motor was connected in. Let us suppose, for the sake of example, that we have 30 motors in the mine, each taking on an average 200 volts, or a maximum of 6,000 volts when all the motors were running. Then, if the circuit were earthed at one end, a motor at the other end of the circuit would have both terminals, and the whole of its windings, at a pressure of almost 6,000 volts above earth.

In the same way, while the P.D. between the two conductors supplying any motor, and in particular one of the smaller motors near the face of the coal, would be comparatively small, both the conductors might be at a high potential as compared with earth. The concentric type of cable is not suitable for these conditions at all; it is suited for cases where the outer conductor is at earth potential, and not for cases like that under consideration, where the outer would be, not at earth potential, but at a potential not greatly differing from that of the inner.

Mr. Walker appears to suggest that the proposed system would obviate the necessity for earthing the frames of motors, or for providing the cables with earthed armouring. How so? If you have a motor, the whole of whose windings are at a pressure of, say, nearly 6,000 volts above earth, surely it would not be safe to leave its frame unearthed, even though the P.D. across the terminals of the motor were only 200 volts? On the other hand, it would be very difficult, if not impossible, to construct D.C. motors, at any rate, at a reasonable price, which would stand a working pressure of thousands of volts between windings and frame, such as would occur if the frame were earthed. I believe that with the Thury system it is the practice to insulate the frames of all the motors, as well as of the generators, by mounting them on insulating supports and surrounding them by insulated floors, which would obviously be impossible in a mine. But unless these impossible precautions were taken, it would not be safe to touch the motors—unless the frames were earthed. And even if the frames could be earthed, precisely the same difficulties and dangers would then present themselves as with the three-phase system.

In a large mine the maximum voltage would have to be very high, to keep the main current (which, as your correspondents in your last week's issue have pointed out, would flow through every part of the circuit) within reasonable limits. Take the case of the 5,000-KW. plant suggested by Mr. Walker. With a pressure of 20,000 volts, the main current would be 250 amperes, and this current would have to be conveyed to every motor, large and small. Think of the cost of cables and the copper losses. Then imagine a D.C. motor with its windings and commutator at a pressure of 20,000 volts and its frame earthed—or, if you prefer, not earthed. I am assuming that the motor is at one end of the circuit and the earth at the other; by earthing the circuit in the centre the maximum pressure to earth could be limited to 10,000 volts, but that would be bad enough.

I believe the speed of the motors in the Thury system is regulated by shifting the brushes round the commutator—not a method that strikes one as being particularly suited to mining conditions, especially in a mine that is at all fiery.

Altogether, it seems to me that mining work is about as unpromising a field for the Thury series D.C. system as could well be imagined.

G. C. Allingham.

Golder's Green, N.W., *January 6th*, 1913.

Earthing the Neutral.

In your current issue, Mr. Fedden gives an interesting description of the earthing arrangements in use at Sheffield, and as the subject is now so much to the fore, I feel that it would be of great service to all of us if he would give some further details of its working, in the light of his experience.

Mr. Fedden says that the earthing transformer has a delta-connected secondary, which ensures that the neutral point of the primary shall always be at earth's potential. By this he means, I presume, under normal working conditions, since it does not seem possible that, on the occurrence of a fault on one of the feeders, resulting in a dead earth, a transformer taking, say, 50 amperes out-of-balance current, could "anchor" the neutral point.

This being so, I am not altogether clear as to how the arrangement differs in its effect from a resistance connected to the neutral points of the generators or transformers, and so proportioned as to allow 50 amperes to pass in the event of an earth. On the other hand, the latter arrangement has one distinct advantage of its own, namely, that no power is consumed under normal conditions.

The use of the resistance, moreover, need not be subject to the disadvantage suggested by Mr. Fedden, namely, that with an earth on a feeder, the supply would be cut off, since the discriminating devices used at Sheffield could equally well be employed, or the still simpler arrangement outlined in fig. 1 of Mr. Peck's paper, which, as I pointed out in the discussion, admits by a slight modification of the inclusion of overload protection, as well as protection against earths, and this, moreover, without the use of any additional gear. The overload and earth fault relays are quite independent of one another, so that the latter can be set to trip with as small a current as may be required, without interfering with the overload settings.

The cost of the earthing resistance arranged for 50 amperes in the way suggested would not be more than a fifth of that of the corresponding transformer, as installed at Sheffield.

As Mr. Fedden points out, there are three questions which have to be decided in this connection.

1. Whether to earth the neutral at all?
2. If so, whether to earth through a resistance?
3. In that case, what should be the value of this resistance, or, in other words, what should be the value of the current to earth, on the occurrence of a dead earth?

As to questions 1 and 2, I think that all engineers are now pretty well agreed that they should be answered in the affirmative.

As regards the third question, there may be some differences of opinion on the subject, but I am personally in entire agreement with Mr. Fedden in his contention that so long as the earth current is sufficient to trip the feeder breakers, the smaller it is the better for the system.

Kenelm Edgcumbe.

London, S.W., *January 6th*, 1913.

The Case of the Sub-Man.

As a result of the recent correspondence in the ELECTRICAL REVIEW, it has been decided to form an Association, and a meeting is to be held in London during the coming week (as advertised). Inquiries have come in from all over the British Isles, and the idea has been enthusiastically received.

It has been suggested that the "Association" should include shift engineers, switchboard attendants, sub-station attendants, mains assistants, &c., and it is hoped that as many as possible will attend the meeting.

Owing to the large amount of work entailed in answering the many correspondents, inquiries are being answered in strict rotation.

J. W. Ebben.

London, E., *January 6th*, 1913.

I am not one of those worms that take a pleasure in that interesting pastime of personal abuse, but I cannot but pass some remark on Mr. Potter's letter which appeared in last week's REVIEW. Amongst several remarks, he states that the correspondence of a few weeks ago bristles with contradictions; that we assume we are "a sort of aristocracy," and then he finishes up with the milkman and yardman question.

Well, in the first place, this Association of Electrical Shiftmen intends to put a stop to such as milkmen and yardmen taking charge of sub-stations, or having anything to do with our branch of the profession. As regards a "sort of aristocracy," it might be information for Mr. Potter to know that there are gentlemen in power and sub-stations, and that these are not entirely run by milkmen and such. The majority of attendants are well educated, have had a college training, some hold Honours Certificates from the City and Guilds of London Institute, while several have University degrees. I, therefore, cannot see how they can be compared to the common wiremen, who more or less are from the middle and lower class. I, myself, started by serving my time with wiring contractors (for which I am not sorry), and as an apprentice was sent out with the professionals. I remember one particular case where we were working in a flour mill, and one morning the professional whom I was with asked the foreman for 2d. to buy candles, which he said he required when working in a dark corner; he was given the 2d., and on arriving at the mill I asked him whether he had bought the candles. The reply I received was: "Sure we don't want candles at all—wasn't it for a pint I got the 2d.?"

There is a specimen of your wiremen. Do they try to improve their knowledge as regards their trade? No, but they attend the technical schools, not to learn anything, but to increase their kit of tools at the expense of the workshop, and the result is that they do not know the difference between an ampere and a volt.

Then how would it possibly be practicable to be a member of the same Trade Union as the wiremen who are working under our direction in the stations? There would be no respect for us, and the result would be "Hey! Bill, is this right?" and discipline would be all awry. Another reason is that if we started an ordinary Trade Union we should be just as ordinary tradesmen (not that that is a disgrace to any man), but we hope, with Mr. Potter's permission, that we are a step above the average tradesmen.

One cannot but think that Mr. Potter is of a Socialistic turn of mind from the tone of his letter. In a study of human nature Mr. Potter will see that in every class, from the very poorest to the millionaire, snobbishness is to be found; it cannot be helped, for it is born with man, and even the electrical shift engineers are no exception.

The close of Mr. Potter's letter very much resembles a well-thought-out advertisement. Is he afraid that the Association of Electrical Shiftmen will rise in opposition to the Electrical Trades Union? Let him not tremble, we will not affect him financially or otherwise, and he may be sure that we will keep as far away from Trade Unionism as possible, even though the House of Commons dabbles in it.

Perhaps it will interest Mr. Potter to know that I have heard that hundreds of individuals have already joined the Association of Shiftmen.

I take this opportunity of making it clear to readers of this REVIEW that the "Association of Shift Engineers" and the "Association of Shiftmen" are identical. It was a mistake of mine that changed the name of the former.

Motor-Generator.

With reference to the letter of Mr. J. Potter in last week's issue of the REVIEW on this subject, there are two things that must have been noticed by your readers in his letter, namely:—First, it is typical of the majority of the effusions that have emanated from the E.T.U.; secondly, it is remarkable by being so wide of the mark, and offering no feasible or workable suggestions.

Mr. Potter touches on a number of points, and is careful to avoid following them out too far. He speaks of yardmen, &c., carrying out central-station engineers' duties, as though this state of things were peculiar to the central-station staffs; but he does not mention anything about those members of the E.T.U. who, a few years ago, were navvies, and such like. Mr. Potter would have us believe that the only thing to do for our benefit is to join the excellent organisation with which he is connected; but if we look back a little on the achievements of the E.T.U., and upon its methods, we cannot find the slightest reason why those members of the profession who are now seeking to improve their position should join its ranks.

What a brilliant success the E.T.U. was in the recent events at Bradford and Glasgow (success, I don't think!). Again, Mr. Potter states that there are already central station men in the E.T.U., but he does not mention anything as to the status of these members; seeing that it is only necessary to show that one has been three years at the trade in order to qualify for membership of the E.T.U., I can quite believe his statement about having central-station men as members—station wiremen, jointers, and such like. As to the question of Trade-Union methods not being applicable to the profession, I think any person who is at all conversant with central-station work will see the reasons for this. If it were to serve any useful purpose, I could enumerate a good many reasons, but central-station men are conversant enough with the question, also the matter of wage rates, and such are a question for consideration and adjustment, and not to be settled rashly or haphazardly, as, I am sorry to say, is done by some Trade Unions.

The best work Mr. Potter and his friends could do is to set about making the E.T.U. what it is not at present—an efficient organisation, and one whose ranks would contain only qualified men. Then, and only then, will the E.T.U. obtain the recognition and respect which it is aiming so blindly for at present. Mr. Potter shows up his object very clearly in concluding his letter, by saying that the "E.T.U. will welcome recruits"; this seems to be about the only decided line of the organisation—"gather 'em in"—but to talk of central-station shift engineers finding a remedy for their grievances by joining this Union is too rich altogether. The shiftmen can, and intend to, form an independent Association, and can do so very nicely without the assistance of Mr. Potter and his friends.

There are many other points in question which could be gone into in print, but to attempt to discuss the matter with those who are wandering so wide of the mark as Mr. Potter is doing would be only a waste of time and space. Let him get some first-hand knowledge of the subject, and he will find that his organisation is as far removed from the business of the shiftmen, as Jupiter is from the place where they don't use radiators.

Zantha.

I have read with interest Mr. Potter's letter in last week's issue, and, being a subman myself, I cannot agree with him in a lot of things he states.

According to Mr. Potter, the interests of wiremen and station engineers are alike, or both classes are trades, and Trade-Union principles apply to both.

We unfortunates in sub-stations are badly enough off without putting ourselves on the same level as the tradesmen; in the first place, the average shiftman is a man of some education, and a very large number of them are gentlemen. They have some technical training, and they are socially well above the average wireman. The average wireman, on the other hand, is usually a man drawn from the lower classes; he has practically no education worth talking of, he does his work, no doubt, all right, but the most elementary question in electricity would stagger him.

Again, the average wireman can never become more than a wireman on account of his lack of education and technical knowledge; he will get his Union pay (with luck) all right, but will he ever rise beyond that? For that reason the E.T.U. is of no use to us.

Mr. Potter accuses us of "snobbishness"; but, personally, I fail to see how we are guilty in that respect. It is no crime for gentlemen to keep apart from men who do not enjoy the same social position as they do, even if it is their misfortune to be "shiftmen."

How many of us, I should like to know, would like to get our start in life again at any of the other professions which, at least, protect their men, if we only knew then what a miserable business was in store for us, where money and influence, not brains, was the principal road to success.

As to the engineers who have joined the E.T.U., what have they to look forward to? A wireman's wage at the outside, with luck, and it is quite enough for them if they class themselves as such.

I am glad to see that the "Association of Shiftmen" is being formed, and the idea is being taken up in all parts of the country.

Booster.

The Preservation of Telegraph Poles.

We notice an article on page 33 of your issue of January 3rd, which, of course, refers to uncreosoted or unpreserved cedar poles in America, and we think this is not made quite clear, as the method suggested of preserving the same is no doubt excellent, but should be quite unnecessary with properly creosoted poles in this or other countries.

For **Richard Wade, Sons & Co., Ltd.,**

Christopher Wade, *Managing Director.*

Hull, *January 6th*, 1913.

THE PHYSICAL SOCIETY EXHIBITION.

(*Concluded from page* 12.)

Crompton & Co., Ltd.

Besides their standard potentiometer, and various patterns of switchboard instruments, this firm exhibited a new D.C. testing set (fig. 8). This instrument consists of a moving-coil indicator

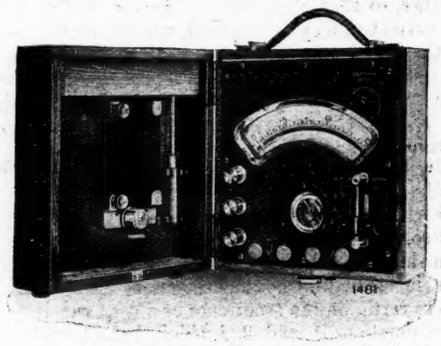
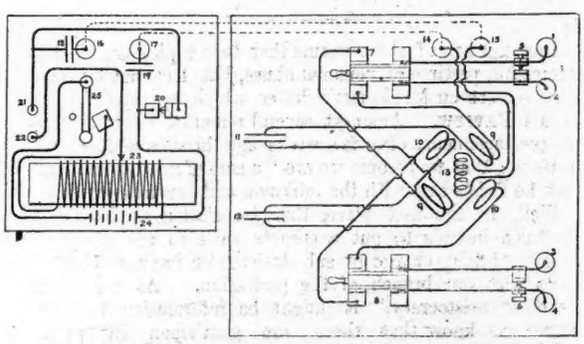


Fig. 8.—Crompton D.C. Testing Set.

mounted in a light and strong portable oak case. It can be used either as an amperemeter or as a voltmeter, a selector switch being provided for coupling the instrument. The voltage range is altered by means of a volt-range switch, so arranged that on closing the case the switch is automatically and certainly set to the highest range; this reduces the risk of applying a high voltage to a low-voltage range. The shunts are specially designed, and are of manganin, the smaller shunt being inside the instrument. The 150-ampere shunt is used externally, but is fixed inside the lid when the instrument is being carried about. The instrument is magnetically shielded, and is adjusted to a definite resistance and degree of sensibility. Without its shunts or resistances it forms a milliamperemeter reading up to 15 milliamperes, or a millivoltmeter reading up to 75 millivolts. Any slight change of zero which may take place can be corrected from outside by turning a screw buried in a bush near the lock or catch; a suitable screwdriver is fitted in the lid. The apparatus is standardised as a voltmeter for six ranges, from millivolts to 600 volts, and as an ammeter from milliamperes to 150 amperes. Additional external shunts can be provided for higher ranges.

Marconi's Wireless Telegraph Co., Ltd.

Several interesting novelties were shown by this company. Amongst these was the radiogoniometer in its fully-developed form, or, in other words, the wireless direction-finder on the Marconi-Bellini-Tosi system; this device, when installed on board ship, enables the direction from which signals are received to be determined within a few degrees, a matter of great importance in time of



1, 2, Terminals of first aerial loop; 3, 4, Terminals of second aerial loop; 5, Protecting gap for first aerial; 6, Protecting gap for second aerial; 7, Switch for first aerial circuit; 8, Switch for second aerial circuit; 9, Fixed coil of first aerial circuit; 10, Fixed coil of second aerial circuit; 11, Condenser for first aerial circuit; 12, Condenser for second aerial circuit; 13, Exploring coil; 14, 15, Terminals for connection to detector; 16, 17, Terminals for connection to direction finder; 18, 19, Blocking condensers; 20, Crystal holder; 21, 22, Terminals for connecting to telephones; 23, Potentiometer; 24, Battery of dry cells; 25, Battery switch.

Fig. 9.—Connections of the Radiogoniometer.

fog or when seeking a vessel in distress. It can also be used for directive signalling over a moderate range. The special aerial employed consists of two equal loops suspended in vertical planes and crossing one another at right angles; each of these is connected in series with a coil and a condenser. The coils are of equal size and cross at right angles; the condensers are also equal, and can be simultaneously adjusted for tuning the aerials. A third

coil, inside the crossed coils (see fig. 9), is called the exploring coil, and is mounted on a vertical spindle; it is connected with a detector consisting of a pair of telephones and a crystal rectifier. The principle of the instrument is as follows: Each aerial loop is a directional aerial, which receives best when its plane is in the direction of the sending station, and receives nothing when its plane is at right angles to that direction. Usually both aerials are more or less inclined to the direction of the signals, and receive signals of corresponding intensity, the resultant effect of which is communicated to the exploring coil; when the latter is in the position which gives the maximum strength of signals, the pointer attached to the spindle indicates the direction of the sending station—assuming, of course, that the instrument has been properly fixed with regard to the aerials. A simple testing instrument is used to verify the orientation, resistance and insulation of the aerials.

Improved adjustable ebonite disk and air condensers were exhibited, and a complete portable outfit for communicating up to 15 miles, to be carried in knapsacks by four men. A new "Universal Crystal Receiver" was also shown, intended for a range of 300 to 3,000 m. wave-length, and provided with adjustable condensers in the aerial and detector circuits.

Nalder Bros. & Thompson, Ltd.

In addition to the well-known ammeters, voltmeters, insulation testing set and other instruments shown by this firm, there was a novel device in the form of an insulation recorder and leakage-current indicator for A.C. circuits. The principle involved is that of applying a direct-current E.M.F. from a battery or exciter between the A.C. mains and earth as illustrated in fig. 10, which refers to an unearthed three-phase system. The choking coil limits the alternating current to earth in case of a bad fault. The recorder and relay, which are permanent-magnet instruments, are operated by the direct current flowing round the circuit *via* the insulation resist-

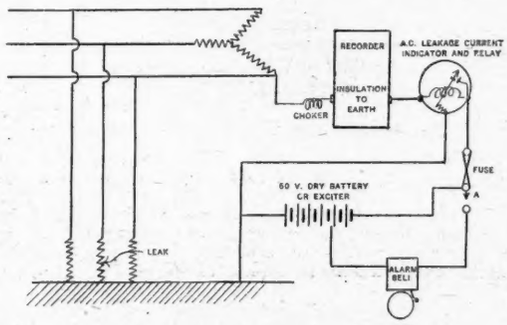


FIG. 10.—CONNECTIONS OF NALDER INSULATION RECORDER AND LEAKAGE INDICATOR.

ance. The recorder is calibrated to register the insulation to earth, and operates on the tapping principle. The relay is calibrated to indicate the maximum A.C. leakage current flowing from main to main consistent with the resistance recorded at the moment.

When the insulation resistance falls below a predetermined value, the relay makes contact, throwing the fuse directly across the battery; the fuse blows, allowing the alarm-bell circuit to be completed at A, and cutting the instruments out of circuit. These sets of apparatus have already been installed in many high and low-pressure systems both with and without the neutral earthed.

Helsby Wireless Telegraph Co., Ltd.

The Helsby vibration-proof crystal detector and rotary quenched-spark discharger were shown.

Weston Electrical Instrument Co.

This company showed a great variety of switchboard and portable instruments of the Weston type, as well as testing sets, laboratory instruments, frequency and power-factor meters and synchroscopes.

Cambridge Scientific Instrument Co., Ltd.

The Féry bomb calorimeter, and various instruments for the measurement of temperature, were shown. The principal feature, perhaps, was the Cardiograph, which consists of an Einthoven galvanometer, photographic apparatus for making records either on plates or on a continuous roll of paper, an automatic projection arc lamp, a switchboard and time-marker. The whole forms a very convenient outfit for producing records of the heart's action over any desired length of time, with the minimum amount of trouble. With the aid of an auxiliary microphone apparatus, graphic records of the sounds of the heart can be made.

Kelvin & James White, Ltd.

The Kelvin balances and other familiar standard instruments were shown, with the Aitken portable dust counter. The Fullarton vibrometer was also exhibited; this is a simple little instrument with a vibrating reed, which can be tuned by various adjustments to resonance with the vibration to be determined, and gives a comparative indication of the intensity of vibration in any given plane.

Dubilier Electrical Syndicate, Ltd.

This exhibit included condensers of mica and tinfoil, for working pressures up to 15,000 volts, as well as a quantity of high-frequency apparatus for therapeutic purposes, which could be used on any public supply system.

THE "PARAGON"-CYCLE INTERNAL-COMBUSTION ENGINE.

NOT content with devising the "Paragon" system of electric propulsion of vehicles and ships, Mr. W. P. Durtnall has invented a new cycle for internal-combustion engines, which appears to possess marked advantages over the well-known systems in current use. His purpose is to expand the products of combustion down to atmospheric pressure, thus obtaining more useful work from a given quantity of fuel, and discharging the gases noiselessly at a low temperature. According to a descriptive article by the inventor in the *Railway Times* of December 28th, his attention was drawn to the subject by the need for a suitable prime mover for use in combination with his Paragon system of oil-electric locomotive for hauling railway trains, in place of steam locomotives; his colleagues, Messrs. H. H. B. Deane and G. T. Bowles, were associated with him in the development of the new system.

In fig. 1 is given a diagrammatic section of the Paragon internal combustion engine as arranged on the two-cycle Diesel principle for use with crude oil. It will be noted that the exhaust ports

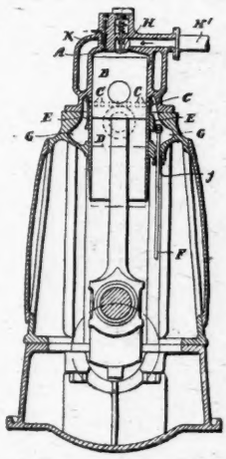


FIG. 1.—DIAGRAMMATIC SECTION OF PARAGON ENGINE.

FIG. 2.—TWO-CYCLE DIAGRAM.

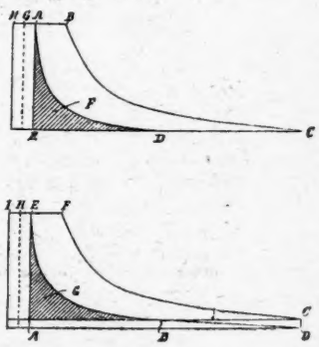


FIG. 3.—FOUR-CYCLE DIAGRAM.

C C are situated at the middle of the stroke of the piston, and are covered by a sleeve E, which is operated from the crankshaft by a rod F. Also a pipe H^1 supplies air at a pressure slightly above atmospheric pressure, through a valve H.

In the figure the piston B is at the top of the compression stroke, and the compression space is supposed to be filled with air at a pressure of 500 lb. per sq. in., and at a temperature of about 1,000° F. As the crank turns the centre, the fuel oil is sprayed into the cylinder through the valve K, and burns during a portion of the stroke; afterwards expansion takes place, but the exhaust ports are kept closed by the sleeve until the end of the stroke, so that the gases expand almost to atmospheric pressure. The ports are then opened, and as the piston returns, the air in H^1, being at a higher pressure than the contents of the cylinder, opens the valve H and scours the cylinder, so that when the piston covers the exhaust ports the cylinder contains only pure air, which is then compressed, as before.

The indicator diagram obtained is shown in fig. 2; here E G is the compression space, while E H is said to represent the corresponding compression space in an ordinary Diesel engine: E C is the atmospheric pressure line, and compression starts at D, the shaded area F representing the work of compression.

The principle can be applied also to the four-cycle type of engine, in which case the scavenging air supply is not required. Fig. 3 shows the diagram in this case. Here, on the suction stroke, the air induction valve is closed at the point B, and the piston runs on to D, expanding the air to a point below atmospheric pressure by the amount C D; the difference of pressures inside and outside the cylinder cushions the stroke and helps the working parts to turn the outer centre without shock, also accelerating the parts on the return stroke. On arriving at B, the piston commences to compress the air, bringing it up to 500 lb. at E; injection of fuel takes place, followed by expansion down to C, and on the return stroke the piston expels the burnt gases. Engines working with gas on the four-cycle system, with compression only to about 80 lb., can be operated on similar lines.

Particulars are given in the article quoted of engines which have been designed of 230 B.H.P., at 900 R.P.M., on the author's system

for Colonial orders, to be used in conjunction with the Paragon system of electric transmission. A 300-H.P. petroleum-electric locomotive for passenger train service on one of the leading British railways, weighing 35 tons, is also described and illustrated; each of the four axles is driven by an induction motor, with a gear ratio of 3·35 to 1, and 10 running speeds are provided, while the engine runs always at constant speed. The fuel consumption per axle horse-power-hour is estimated to be 0·6 lb. of crude oil. A small exciter is provided, as well as a small storage battery capable of lighting, heating and ventilating the locomotive and train. The cooling water is carried in a radiator on the top of the locomotive, and special means are employed to vary the rate of circulation, so as to keep the water at a constant temperature. The author states that the system can be applied to locomotives up to 1,000 H.P., weighing 80 tons, with a drawbar pull at starting of 15 tons.

NEW ELECTRICAL DEVICES, FTTINGS AND PLANT.

The Record Patent D.C. Moving-Coil Instrument.

The desirability of a long scale in a measuring instrument is well understood, but hitherto the angular deflection of the pointer of a D.C. moving-coil instrument has been limited to an arc of 90° or so by the requirements of design of the coil and the poles of the magnet; many attempts have been made to overcome this drawback, but with indifferent success. The usual design, moreover, necessitates either a very long air-gap (with no core to the coil) or

FIG. 1.—NEW "RECORD" AMMETER.

two air-gaps in series, the latter being the customary arrangement. The attempt to shorten the air-gaps has led to marvellous accuracy in the construction of the coil and pole-pieces, but the coil is large and has a fairly high moment of inertia, and any defect in manufacture or fitting leads to fouling.

THE RECORD ELECTRICAL CO., LTD., of Caxton House, S.W., have now developed an entirely new design, giving a scale subtending 300°—not far from a complete revolution of the pointer—and avoiding the difficulties above-mentioned. Fig. 1 shows this feature in the case of an ammeter, and it will be noticed that the scale, which is sensibly uniform throughout, is remarkably clear and easily read; moreover, the divided scale is placed outside the bold figures, thus giving the largest possible

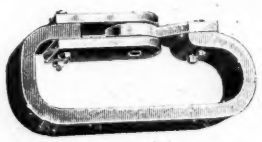


FIG. 2.—MAGNET SYSTEM.

space for the divisions and facilitating accuracy of reading. The scale of the 8-in. dial switchboard instrument illustrated is 17 in. long, and that of the 15-in. instrument is no less than 3 ft. long—in each case about three times as long as in the usual type.

The method by which this large deflection—which can be increased to 330° if necessary—is obtained is shown in figs. 2 to 4. Fig. 2 shows the magnet and pole pieces, which are arranged on the sandwich plan, so to speak, one ring-shaped pole (which also forms the core of the coil) being placed between the two extensions of the other; the shape of the magnet is eminently suited to enable it also to form the backbone of the instrument, carrying the lighter portions. The inner pole-piece is made in halves to admit the coil. There are two air-gaps, bounded by flat surfaces, which are therefore easily made true, and of large area; these also are not in series but in parallel, so that the magnetic reluctance is very low, and this enables a strong working field to be secured, together with great permanence of the magnet and freedom from external interference.

The coil is shown in fig. 3; the active conductors are the upper and lower ones, and the idle length of conductor is short compared with the useful portions; the small coil is therefore of very low resistance, and can be used with shunts giving the usual drop of

FIG. 3.—MOVING-COIL SYSTEM.

0·075 volt. The pointer acts as a counterbalance to the coil, and the moving system is very light and well damped, being almost dead-beat. Large clearance is provided at the ends of the coil, and a considerable slackening of the bearing will not cause fouling. The instrument assembled is shown in fig. 4.

These meters are made both for switchboard and laboratory use, with suitable modifications, the latter type having a mirror and knife-edge pointer. In conclusion, we are informed that the three-fold deflection is obtained without any increase in the expenditure

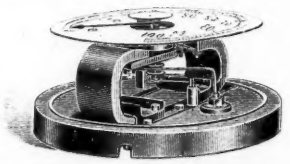


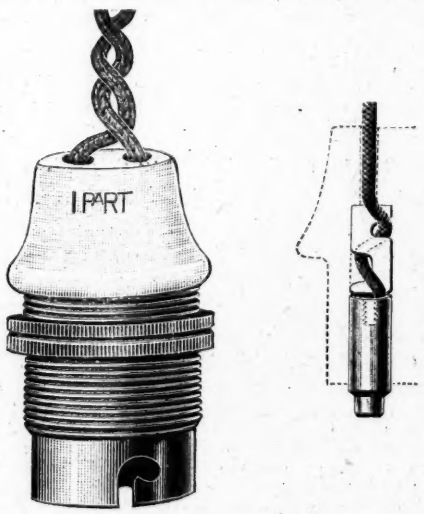
FIG. 4.—INTERIOR OF RECORD INSTRUMENT.

of energy, or, if preferred, advantage may be taken of the long scale to enable the same range to be obtained with one shunt as the ordinary type gives with three shunts. The workmanship is of a very high order, and we were much impressed with the merits of the instrument which was submitted to us for examination. Ammeters and voltmeters are made of all the usual ranges.

"One-Part" Lampholder and Plug.

We have received from MESSRS. G. ST. JOHN DAY & CO., of Mumps Electrical Works, Oldham, samples of their One-part lampholder and One-part plug, both of which represent a marked advance in simplified construction on previous efforts of the kind.

It may be remembered that, last year, we described in these columns one or two ingenious lampholders which, by comparison



FIGS. 5 AND 6.—"ONE-PART" LAMPHOLDER, AND ARRANGEMENT OF TERMINAL.

with the ordinary pattern, were a considerable improvement, and that one of them was the "Mumps" lampholder by the same firm.

The One-part holder consists merely of a porcelain interior with two holes running through from top to bottom, each hole enclosing one wire of the flexible and a terminal plunger, while a standard screwed barrel with bayonet sockets and shade ring is permanently secured to the lower part of the porcelain.

The terminal parts are a sliding fit in their holes and are withdrawn for the purpose of wiring, the bared wire being first pushed through the porcelain and attached to the terminal top by a screw, which has a peculiarly shaped head, projecting some ⅜ in., with notches on either side, round which the wire is looped for greater security; the terminals, once wired, are simply drawn up into their respective cavities by pulling the flex. above the holder.

The above description also applies practically to the plug, which consists of a plain wood or porcelain body with two through holes for wires and plain terminal contacts (instead of plungers). These are also wired in a similar manner to the above.

In either case it will be noted that there is practically no chance of a "short," the leads being separated throughout; the wiring is easy and no tool is required beyond that necessary for preparing the wire itself; the two terminal fittings are the only detachable parts in either holder or plug.

A Cavity-head Screw.

A screw with a head of a novel pattern is being placed on the market by MR. S. SUTCLIFFE, of 3, Central Street, Halifax. As shown in the accompanying fig 7, the head is cupped, and the groove is cut to a larger radius than that of the cup. To turn these screws, a screw-driver with a curved edge is used. Everyone who has had to drive a screw knows the annoyance, and often the

FIG. 7.—CAVITY-HEAD SCREW.

damage, that results when the driver slips laterally out of the groove, but it will be seen at once that these new screws can be driven with ease and certainty, even in the dark. Care is taken to design them so that the head is not weakened, and the spherical cavity is polished, giving a handsome appearance to the finished work. There is less chance, too, of the driver slipping and defacing the head of the screw.

New E.A.C. Car-switch Lift Controller.

THE ELECTRICAL APPARATUS CO., LTD., of Vauxhall Works, South Lambeth Road, S.W., have devised a controller for high-speed passenger lifts, consisting of automatic reversing gear interlocked with an automatic starter on the same panel. The two

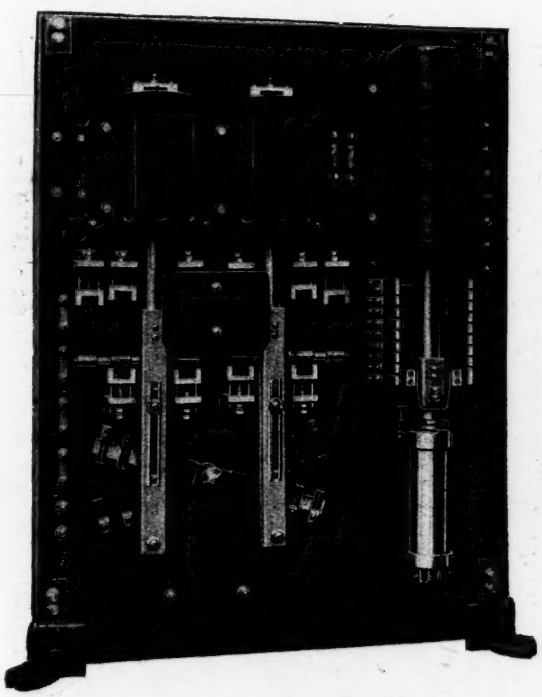


FIG. 8.—E.A.C. LIFT CONTROLLER.

smaller solenoids seen in fig. 8, are for up and down direction respectively, and the centrally pivoted switch at the bottom of the controller (operated by the same solenoids) is for reversing the armature connections. The long solenoid cuts out the starting resistance, the operation being as follows:—When the lift attendant moves the car switch to the "up" or "down" position, the corresponding solenoid on the controller is energised, and its plunger pulled up. During its upward movement the armature reversing switch is closed in the right direction, and finally the circuits to the brake magnet, the starter solenoid and line are completed, and the motor is started with all resistance in. Resistance is cut out step by step by the automatic starter, the speed of which is retarded by a dashpot. The rate of acceleration can be varied by turning a screw on the outside of the dashpot. Current is never made or broken on the armature reversing switch or on the rheostat, the contact-making parts being the cross arms fitted with renewable copper rollers, which engage with large renewable carbon blocks, cushioned and partially hollowed, in order to ensure a definite contact.

As an additional security, a powerful magnetic blow-out is employed, the front shield of which is seen in the illustration, hiding the two line contactors from view. By changing one link on the panel, the control can be removed from the lift cage to two push buttons in the top left-hand corner of the panel, so as to enable the lift to be tested from the motor room with the cage empty. The apparatus is completely interlocked, and it is impossible to start up the motor until the starting resistance is all inserted. An electrical as well as mechanical interlock prevents any possibility of the up and down solenoids lifting together.

New G.E.C. House Service Cut-Out.

The accompanying illustration shows the new pattern of house service cut-out, recently introduced by the GENERAL ELECTRIC CO., LTD. In this design, Home Office requirements have been strictly adhered to; the case is of cast-iron, enclosing the fittings in a very neat manner. There is efficient insulation between the case and

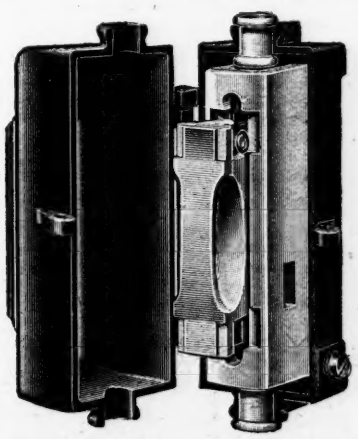


FIG. 9.—G.E.C. HOUSE SERVICE CUT-OUT.

the fittings, and a liberal rating of metal parts. The contacts are sunk in a recessed porcelain block, thus rendering it impossible to make accidental contact with live parts when replacing the fuse holder. The fixing holes are drilled under the porcelain cable bushes. The capacity of the cut-out is 10 amperes.

B.T.H. Theatre Dimmers.

THE BRITISH THOMSON-HOUSTON CO., LTD., of 77, Upper Thames Street, E.C., are supplying metallic dimmers in several types, for fixing flat against, or at right angles to, wall or switchboard, and

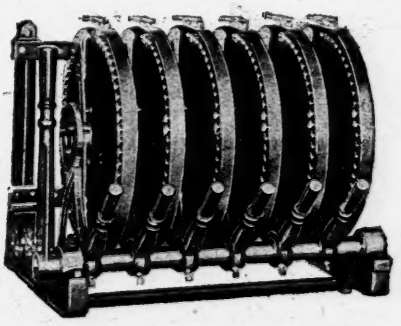


FIG. 10.—B.T.H. THEATRE DIMMER.

for mounting in dimmer banks. Dimmers consisting of two or more plates may have a single lever for the control of all plates, interlocking individual levers, or non-interlocking individual levers.

Every dimmer is made up of one or more standard plates, which can be added to or decreased in the same way as a sectional bookcase. It is thus possible to modify the equipment without waste of time, material or money.

In the B.T.H. design, fig. 10, a perforated cast-iron plate encases a special composition, embodying resistance elements having a negligible temperature coefficient, which are held firmly in place by

cement, which is a highly efficient heat conductor and electric insulator. The contact segments are arranged to ensure against the possibility of arcing from point to point, and to prevent the accumulation of dirt between the segments. The use of wall type dimmers is recommended where only a few lamps are to be controlled, as in small cinematograph theatres, churches, &c. In the interlocking two-wire type each plate has an individual lever, which can be interlocked by a slight twist of the handles, so that any one or all of the plates can be operated by the master lever, In the interlocking three-wire type, each pair of plates is controlled by a small lever which, when interlocked, can be operated by the master lever in a similar manner. The levers are attached to a shaft which is carried on self-centring bearings and an extension of the horizontal arm of the end frame. This method of mounting is used for both the interlocking and non-interlocking types.

BUSINESS NOTES.

Consular Notes.—Russia.—The Austrian Consul at Kieff reports that quite small electric motors find a very good sale in his district, and there is also a fair market for large dynamos. There are quite a number of purchasers who prefer foreign machinery to the home constructed variety. In consequence of the high duty on steam engines and dynamos, steam turbines coupled to dynamos have recently been imported. These machines actively compete with separate steam engines, Diesel motors, &c. Incandescent and arc lamps are being imported in larger quantities, but it must be borne in mind that the home production of carbon incandescent lamps is showing an important development. There are two works in Moscow and one in Warsaw for the production of these lamps, which have also taken up the manufacture of metal-filament lamps, and have dealt a serious blow to foreign manufacturers. The result will be that one or other of the large foreign works will establish branch establishments in Russia. The demand for arc lamps has been appreciably affected by the high power metal-filament lamps. For lighting materials in general, Germany is the chief supplier, but Austria has recently begun to show active competition, one Vienna firm having achieved considerable success. Imports of dynamos, electric motors of every kind, and transformers, in 1911 amounted to 234,000 pouds, valued at 5,838,000 roubles, as compared with 162,000 pouds, valued at 4,471,000 roubles, in 1910.

Russia.—The British Consul at Riga reports that imports of machinery, which rose considerably in 1910, increased still further in 1911. The greater part of the machinery imported is destined for industrial use, and goes in transit for the interior. If we compare the years 1910 and 1911, we find that in the former year 5,690 tons of agricultural machinery, and 10,478 tons of industrial machinery were imported into Riga, whereas for 1911 the figures were 6,349 and 18,992 tons respectively. If we go back as far as 1901, we find the respective figures given as 824 and 5,248 tons; this serves to indicate the great advance in imports of machinery in late years. The United Kingdom is by far the greatest supplier of industrial machinery. According to available statistics, Sweden holds first place in the supply of agricultural machinery at Riga. She is improving her position in the production of industrial machinery, and thus threatens Germany's position as the country second in importance to the United Kingdom in this branch of Riga's imports.

Later in his report the Consul states that the consumption of electrical energy has developed each year from 1906 to the present time. The electric station has met a greatly increased demand for light, but the most notable feature in 1911, as in the previous year, was the increased demand for electricity for power. In 1911 more than 2,000 electric meters came into use, or nearly as many as the total number in use in the first four years of the electric station's existence (1905-9). The increased demand for electricity made it necessary to extend the electric station, and a turbine-generator of about 3,000 H.P. was accordingly added. This was supplied by a German company. The total length of the electric tramlines at the end of 1911 was estimated roughly at 42 km. No new lines were constructed during the year.

Brazil.—The Austrian Consul at Sao Paulo reports that in 1911 18 new concessions for telephones were granted, so that the number of existing telephone companies increased to 61. The system covers over 4,500 km. The Government proposes to bring about the further improvement of the telephone service, and to help to remove existing difficulties which result from poor material, thin wires, and faulty personnel. Moreover, a reduction of the subscription is proposed, the present annual subscription within the kilometre radius being 160 milreis.

Later, in his report the Consul states that the extraordinarily favourable industrial condition of Sao Paulo must naturally lead to a large expansion of trade. Most of the business is done through large importing merchants, and the investment of capital in the district has been an important factor in securing trade. A firm wishing to establish itself in Brazil, and to participate in the trade, must be so well capitalised that it can make considerable sacrifices to begin with, can undertake a strenuous advertising campaign, and—what is particularly important in the machinery trade—give long credits, as well as share in financing new undertakings from which orders may be looked for. Almost daily, at the present time, details of new undertakings appear in the papers, of which only about 50 per cent. are more than unformed ideas. Readers of such notices are apt to take it for granted that these notices all refer to *bonâ fide* undertakings, and may just happen to pitch on one that is not. Experience leads them to ignore these notices in future, and thereby they may miss an excellent opportunity. All that is required is a knowledge of local conditions, and a power of discrimination, and these requirements can only be obtained on the spot by means of an efficient representative.

Uruguay.—The British Consul at Monte Video reports that on January 8th, 1912, a decree was published making obligatory wireless telegraphy installations on all passenger ships carrying passengers between Uruguay and other ports from May 1st, 1912, but the operation of the decree was subsequently postponed to August 15th, 1912. By the decree, ocean-going steamers must have apparatus powerful enough to receive and transmit messages from and to a distance of 400 km. (248½ miles). The Marconi station at Maldonado was closed down on March 23rd, its work being taken over by the Government installation at Cerrito (Telefunken system). The proposed installation in Lobos Island, referred to last year, has not yet been taken in hand, and the erection of a lighthouse on English Bank has also been deferred; but the wireless station on English Bank is now working, and will be a great boon in stormy weather.

Elsewhere in his report, the Consul points out that the principal impediment in the way of British firms not already established in the Uruguay market is the difficulty of finding British agents in Monte Video. The British firms already existing in Monte Video are, in most cases, so occupied with their present business that they have little desire to take up new agencies, especially if the goods are new to the market and the terms nothing exceptional. This applies also to Uruguayan firms, with whom there is the further difficulty of dealing in Spanish. Accordingly, letters from British firms to traders in Uruguay offering agencies frequently find their way to the waste paper basket, or meet with an evasive reply, for it is now axiomatic in Monte Video that if a foreign firm has business worth offering, it will send a competent member of the firm to choose an agent. The fact is well known to British importers to South America, whose commercial travellers now include Monte Video in their South American itinerary. Some, however, have concentrated on the larger market of the neighbouring metropolis of Buenos Ayres without seriously considering the possibilities of business in Uruguay. Where British agents are unobtainable in Uruguay it is better policy to appoint Uruguayans, in preference to any of the firms of the nationalties of our competitors. It would seem hardly necessary to repeat the perennial warning that the metric system is enforced by law in Uruguay, where tradesmen are fined for using any other system, and that correspondence with Uruguayan firms should be conducted in Spanish, were it not that catalogues and circulars are still sent to Monte Video, printed in English, with quotations in British weights and measures. Perhaps the greatest obstacle to the expansion of the import trade is the high protectionist Customs tariff, which dates from 1870, with subsequent alterations imposing in most cases additional duties. The United Kingdom is, however, on the same footing as her European and North American competitors, as there is practically one uniform tariff for all countries, without any preferential scale. In 1907 a new Customs tariff was published, further increasing the duties, but was not adopted. In view of the recent increases in public expenditure, it is feared that no remission of Customs duties is to be hoped for, although the best authorities are of the opinion that the Customs revenue would not suffer by a reduction by 10 per cent. of the present duties. The Customs duties at present provide over 60 per cent. of the public revenue. A Bill was introduced in July, 1912, for raising considerably the duties on iron and steel and certain other goods. The main purpose of the Bill, as explained by the proposer, was to enable local manufacturers to carry on business without loss in the event of an Eight Hours' Bill becoming law. The tendency is to meet the expenses of new public works by means of temporary additional Customs duties, but unfortunately when the work is completed and paid for, the temporary duty remains as a permanent one. This policy has done much to increase the cost of living, which is now alarmingly high—having increased by about 50 per cent. in 10 years.

Germany and the Sales of Large Gas Engines.—A Sales Syndicate has recently been established in Cologne by all the German builders of large gas engines. The object of the syndicate, which has been formed for a period of six years, is to equalise the orders given out between the different builders, and to institute a uniform set of sale and delivery conditions.

Spain.—La Sociedad Espanola de Electricidad Allemanna Svenska is the name of a new company which has lately been formed in Madrid, with a capital of £30,000, to develop the sale of the Swedish Electrical Co.'s productions in Spain.

Calendars and Diaries.—From MESSRS. ALFRED GRAHAM & Co., St. Andrew's Works, Crofton Park, London, S.E., we have received a blotting pad worthy of a place on any desk, with a blotter diary at left hand, with ample daily spaces and calendars for 1913-4. Another souvenir of equally practical value from this firm takes the form of a useful pocket volume of some 250 pages containing speed and tide tables for 1913—daily tide tables for the principal seaports of the United Kingdom, port charges, knot tables, distance tables, electrical terms, engineers' tables, weights and measures, postal information and blank pages for memoranda.

THE WESTINGHOUSE BRAKE CO., LTD., of 82, York Road, King's Cross, London, N., has issued a wall calendar for 1913, with tear-off monthly sheets, each of which contains a half-tone illustration of a Westinghouse-Morse chain drive.

MESSRS. W. H. WILLCOX & Co., of 38, Southwark Street, London, S.E., have issued their usual date remembrancer for the year, each

monthly sheet being conspicuous for the abundance of illustrations of the manufactures supplied by them.

MESSRS. NALDER BROS. & THOMPSON, LTD., of 34, Queen Street, London, E.C., have issued one of their now quite familiar handy-sized calendars, with monthly tear-off slips for 1913.

From MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., of Blomfield Street, London Wall, E.C., we have received a wall calendar of artistic design, with date slips for the year, each of which gives six working days, these slips being for the most part appropriately illustrated with pictures of the company's manufactures, &c.

Considered from some standpoints, the 1913 calendar of the JANDUS ARC LAMP AND ELECTRIC CO., LTD., is as "taking" as anything we have this year seen, though others, as we have already stated, are excellent from their special point of view. The picture, we understand, is reproduced from an original water-colour drawing, prepared for the firm by M. Connorton. It is quite different in style from their productions of the last year or two, and as there is no title or explanatory note we are left to guess the nature of the thoughts which give the charming damsel such heavenly satisfaction. We will resist the temptation to break forth into poetry concerning my lady's eyebrows, pretty lips, a thornless rose, and other features which move the soul even of the prosaic technical journalist. The Jandus Co. (Hartham Road, London, N.) will be pleased to send a copy to anybody interested in their manufactures.

MESSRS. MAVOR & COULSON, LTD., of 47, Broad Street, Mile End, Glasgow, have prepared a wall calendar for the year with monthly date slips with very plain figuring. An illustration of the "Pick-Quick" electric coal-cutter adorns the card.

THE BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, have issued a wall calendar consisting of 13 large monthly sheets up to, and including, January, 1914. Each sheet has the current month's dates in large type, and the previous and following months above in smaller type on the left and right hands respectively. Between these upper date spaces there is, on each sheet, a photographic half-tone reproduction of a colliery power station or textile installation, haulage gear, or other feature of the company's manufactures.

From the LIVERPOOL ELECTRIC CABLE CO., LTD., of Liverpool, we have received a very neat wall calendar for 1913. The monthly tear-off slips have very plain figuring. The upper half of the card contains a general view of the company's new works which were opened in June last.

As a New Year souvenir the BENJAMIN ELECTRIC, LTD., of 117, Victoria Street, London, S.W., have issued to all the London central station engineers and contractors one of their Benjamin telephone cards, whereon are printed the names and telephone numbers of all the leading wholesale distributors of electrical supplies to whom the engineer or contractor can telephone for his requirements. Spaces are left wherein to add the names and numbers of other firms with whom the recipient does business.

Book Notices.—*Willing's Press Guide.* 1913. London: 125, Strand. Fortieth annual issue.—Nothing new occurs to us in regard to this book. As we have said repeatedly, we find it a very conveniently arranged guide to the Press, whose cost (1s.) brings it within the reach of everybody having a use for such a publication.

"The Märkische Electricity Works." By Prof. Dr. G. Klingenberg. Fully illustrated description. From the Allgemeine Elektricitäts-Gesellschaft, Berlin.

Dissolutions and Liquidations.—VACUUM ENGINEERING CO., LTD.—This company is winding up voluntarily, with Mr. J. A. Heiron, 30, Moorgate Street, E.C., as liquidator. A meeting of creditors is called for January 16th.

GEORGE REED, heating and electrical engineers, 11, Chapel Ash, Wolverhampton.—Messrs. G. Reed and F. W. Stubbs have dissolved partnership. Mr. Reed will continue the business, and attend to debts.

ELECTRICAL ADVERTISING CO., LTD.—This company is winding up voluntarily, with Mr. N. C. Meredith, 13 and 14, Abchurch Lane, London, E.C., as liquidator.

NATIONAL TELEPHONE CO., LTD.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. Geo. Franklin, Telephone House, Victoria Embankment, E.C., by February 1st.

MICA SUPPLY CO., LTD.—A meeting is to be held at 19, St. Dunstan's Hill, London, E.C., on February 6th, to hear an account of the winding up from the liquidator, Mr. P. Farnan.

Catalogues and Lists.—THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—Revised edition of the firm's telephone list (between 60 and 70 pages). This list differs from the last edition mainly in respect to the prices quoted, most of them being completely changed; contractors and others interested should, therefore, secure copies at once. The list is fully illustrated, and the contents cover direct-working, battery call and intercommunication telephones, central battery, military, navy and traction telephones, fire alarms, water level indicators, watchmen's tell-tales, &c. Also new small leaflets relating to "Magnet" nursery requisites, "Ideal" electric toasters, and Holophane office shades.

THE BRITISH INSULATED AND HELSBY CABLES, LTD., Prescot.—New leaflet (P. 122) containing illustrated description with prices of the Prescot automatic motor starters for continuous-current motors.

THE ENDOLITHIC MANUFACTURING CO., 61½, Fore Street, London, E.C.—Leaflets with samples of their metal, ivory and bone labels; also a sample of a metal advertising knife, with 6-in. rule marked thereon.

THE METALLIC SEAMLESS TUBE CO., LTD., Meta House, Birmingham.—Illustrated and priced leaflets relating to their popular lines of glass lamp shades.

MESSRS. SIMPLEX CONDUITS, LTD., 116, Charing Cross Road, London, W.C.—Four-page supplementary list, V2(453), in which they give prices and illustrated description of C.C. dynamos and motors, starters and shunt regulators. They are now introducing a range of these motors up to 20 H.P. and dynamos up to 17 KW. Another publication, ZI (460), contains particulars and prices of the firm's new types of electricity meters, in addition to those shown in the recently issued general catalogue. Prices have been revised.

MESSRS. D. H. BONNELLA & SON, LTD., 58 and 60, Mortimer Street, Cavendish Square, London, E.C.—Electric bell catalogue, containing 44 pages of illustrations and clearly stated prices of a great variety of electric bell accessories, bells, indicators, batteries, wires, pushes, and so on.

MESSRS. AUSTIN WALTERS & SON, 57, Lower Mosley Street, Manchester.—22-page well illustrated and descriptive price list relating to their stage arc lamps, flame lamps, bunch lights for theatres and music halls, theatre dimmers, theatre battens, cinematograph stand-by resistances, &c. The firm have put down new machinery for the manufacture of electrical signs, and the list shows some of these—interchangeable letter signs, cinema signs, &c.

MESSRS. LANDIS & GYR, LTD., 28, Denman Street, London, S.E.—16-page catalogue containing illustrated particulars with tabulated prices of D.C. ampere-hour and watt-hour meters, single-phase and polyphase meters, A.C. indicating wattmeters, special-tariff meters, change-over switches, time switches, and other manufactures of the same class. Diagrams of connections, also dimension sketches, are given.

MESSRS. WILSON HARTNELL & CO., LTD., Volt Works, Leeds.—New eight-page catalogue, containing general and technical description of their polyphase induction motors, with tabulated prices, dimensions, shipping weights, &c., for sizes from 2 to 100 H.P. A couple of pictures of the works are included.

Trade Announcements.—MR. J. W. F. WARREN has left the service of the British Westinghouse Electric and Manufacturing Co., Ltd., to take up the management of Messrs. George Cradock & Co., Ltd., wire rope manufacturers, Wakefield. Messrs. Cradock have had a branch office in Johannesburg since 1897, and in addition to selling their own products have represented other British firms. We understand that they are now prepared to further represent electrical firms. Mr. Warren will sail for South Africa about the middle of February.

THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., of 109/111, New Oxford Street, London, W.C., announce that from 1st inst. they have taken over the agency of the Vereinigte Isolatorenwerke, of Berlin, covering the whole of their manufactures with the exception of traction material, viz., Ambroin handles, shields, washers, bushes, terminal blocks, circuit-breaker and controller, arcing shields, insulated bolts, switch bases, meter boards, &c.

Owing to increased business, the STANDARD ELECTRICAL ENGINEERING CO. have acquired larger premises. Their address is now 39, Eastcheap, E.C. Telephone: "4934 Avenue."

MESSRS. W. V. WAITE & CO., LTD., have now established themselves at the Alpha Works, Taffs Well, Glam. They have concluded an agreement with Messrs. W. Partington & Co., of Taffs Well (who have for some years carried on business in electrical repair work), for whom they will now act as sole concessionaires.

THE "RADIUM" ELECTRIC CO., of 82, Hatton Garden, London, E.C., announce that in order to avoid patent litigation they have given up the sale of their "Radec" squirted filament lamp—except for export—and have now been appointed special factors by the Tungsten Lamp Association for drawn-wire Osram, tantalum, Mazda, Wotan, or any other conference lamps, which they can offer at the full conference discounts. They will hold large stocks of all these makes.

MESSRS. PITTERS PATENTS, LTD., have taken additional offices in the City in order to cope with increasing business. All communications in future should be addressed to 20, Bishopsgate, London, E.C. Telephone No.: "London Wall 6779."

THE ARMORDUCT MANUFACTURING CO., LTD., of Farringdon Avenue, London, E.C., have acquired the sole licence for the manufacture and sale of Mr. Napier Prentice's "Lightning" cooking oven, which will be on the market some time in February.

Annual Dinner.—The Annual Dinner of the drawing office staff of MESSRS. WILLANS & ROBINSON, LTD., was held at the Grand Hotel, Rugby, on Friday, December 20th. The chair was taken by the chief draughtsman, Mr. E. R. Briggs, who presided over a large and representative gathering, including Mr. Peache, Mr. Davenport, Mr. Bennett, and representatives from all departments. Telegrams of regret were received from Mr. Hemmings, who was away on the company's business, and from Mr. Symonds (an old Willans man), of the Brush Co.; Mr. Cox and Mr. Elborne were also unavoidably absent. After the usual loyal toast, the chairman proposed the health of "The Directors," and expressed great satisfaction in being able to welcome two directors this year to their dinner. Mr. Davenport, in the course of an appreciative reply dealing with the company's work, bore special testimony to the spirit of loyalty and honest work that was so prominent a feature in all ranks of the company's staff, and expressed the opinion that such an asset, coupled with the confidence which customers were exhibiting, were hopeful omens for the company's future. Mr. Peache also spoke, and said that Mr. Briggs had told them that he had made a special journey to Rugby on purpose to be present at the dinner, and he could only say that in finding himself among them all he felt fully rewarded. His connection

with the company dated back many years, to the days when the building of steam launches on the Thames constituted its main business. It was a regret to him that he saw to-night so few of the old faces round him. It rested with each one to do his level best and back up Mr. Davenport in his arduous task, and to see that so far as in him lay the company should win back to its old prosperity. Mr. Prosser proposed the health of "Friends, Absent and Present," and noted that the company was losing the services of Messrs. F. W. Stokes, J. Burns and the Brothers Pfleiderer. He wished them every success in their new sphere of work. Mr. Wood responded to the toast. Mr. Pocock and Mr. Wells, who represented the company in Australia and Canada, were remembered by letters of greeting, which were signed by everyone present. The toast of "The Ladies" was proposed by Mr. Bennett, and Mr. Nitschke responded on their behalf. An excellent musical programme was arranged by the secretaries, Mr. Gardner and Mr. Seymour.

Trade in 1912.—We have received an advance proof of the "Annual Trade Review of the *Chamber of Commerce Journal*." It is an interesting and valuable document, and in the Section relating to electrical trade statistics the following values and weights are given to show the course of the export and import trade in electrical goods for the 11 months ended November 30th, 1911 and 1912 :—

EXPORTS :—

	1911.	1912.
Electrical goods and apparatus (other than machinery and telegraph and telephone wire)—		
British	£2,607,052	£4,049,758
Foreign	179,588	205,699
Electrical machinery—		
British	20,601 tons £1,638,849	21,838 tons £1,780,832
Foreign	530 tons £54,136	5,242 tons £63,486

IMPORTS :—

Electrical goods and apparatus (other than machinery and telegraph and telephone wire)	£1,296,848	£1,320,182
Electrical machinery	974,627	1,056,181
" "	8,673 tons	8,145 tons

Messrs. Switchgear & Cowans, Ltd., of Salford, report that their works in Springfield Lane were fully occupied during 1912. The more interesting items constructed included E.H.T. transformers ranging from 40,000 volts to 60,000 volts and from 5 to 50 KW. Remote-control oil switches for very large capacities operating chiefly at 6,600 volts and at 12,000 volts also deserve to be mentioned as forming a feature of last year's output. The firm's patterns of mining switchgear have been standardised, and a draw-out system has been developed. Star-delta and automatic transformer starters have been remodelled and their operation made entirely independent of the attendant, who has merely to switch on. A new patent has been applied for, for improvements in the Statter patent time lag, and patterns have been standardised, providing for independent adjustment both of the time and the current settings. Complete central-station equipments of switchgear for several important stations at home and abroad have been completed during the year, and the contracts in hand include switchgear equipments for Manchester, the London County Council, Hull, Kingston-upon-Thames, Montreal, Windermere, Seville and other places.

Messrs. Leopold Farmer & Sons, surveyors, auctioneers and factory specialists, London, report that the sales and letting of factory property, wharves, land, &c., in the year under review, show better results than was the case in 1911, the boom in trade in the industrial world having given a great impetus to the development of new industries, and the consequent establishment of new works. Prices have been maintained, and sales transacted at good times prices. They would not, however, convey to the reader that the standard of values has been kept up, as hardly two factory properties are alike. The tendency is for the price to rise, consequent on the improvement by development in certain manufacturing areas which have special advantages in rail, waterside and other facilities, but the migratory movement amongst manufacturers is to districts outside large towns where the lowest possible cost of manufacture can be obtained. The values of industrial properties have not to any great degree been affected by the Budget Taxation of 1909, but as regards other securities in landed property, a shrinkage is noticeable. It is difficult to say which branch of any particular manufacture more than any other has progressed in the year 1912, as there are many influences affecting industrial operations and the development of commercial enterprise. Acquiring of factories, &c., building of works consequent on reorganisation and extension in many trades, are always in progress. Owing to the flourishing state of trade, great developments have taken place in the year under review, especially in the following :—Engineering, milling, chemical, spinning, motor and rubber trades. The effects of the Patents and Designs Act are still well to the front, a sum amounting to about 1½ millions having been expended in the acquiring of land, building of factories and plant, and machinery equipment, and the consequent employment of some thousands of workpeople. Foreign holders of English patents are still on the lookout for factory property to comply with the requirements of the Act, and several areas in and around London and the provinces have been developed in consequence of the establishment of important industries which give employment to thousands, and additional rates to local and other attendant authorities. The outlook ahead for further deals in factory property is good, as there is every likelihood of a continuance of prosperous activity in the industrial world.

A Scottish correspondent writes :—"Electrical engineering firms in the West of Scotland are active and have an excellent order book. Trade has been good of late months, particularly with firms who specialise in work of a distinctive type. Messrs. D. and J. Tullis, Ltd., Glasgow, have in hand important contracts in connection with the equipment of electrically-driven steam laundries on board large passenger ocean liners. Another Glasgow firm, Messrs. Drysdale and Co., Ltd., do a large trade in fitting up electrical-driven pumping sets for power stations. They have work in hand to supply establishments at home and abroad, and look forward to the new year with satisfaction. In connection with marine work the introduction of electricity as applied to steering gear is taking a firm hold. Especially is the patent electric hydraulic steering getting into favour with marine engineers. A set is at present being supplied to a British warship now building. Messrs. John Hastie & Co., Greenock, are doing a considerable amount of work with the "Hele-Shaw-Martineau" electric hydraulic steering gear; and are executing orders for motor-driven ships. Messrs. Davis and Primrose, Leith, specialise in bevelling machines, for which they hold the patent. One of their bevelling machines for the British Naval Dockyards is for dealing with angle and other sections up to 14 in. broad and 1¼ in. thick. This machine weighs more than 20 tons, and is driven by two electric motors. Another machine is on its way to Japan; and machines have been supplied to Portuguese, French, Russian and Norwegian shipyards. Messrs. Mavor & Coulson, Glasgow, are busily engaged upon electrical mining apparatus. At present an extension of workshop accommodation is in hand. Messrs. Osborne & Hunter, of Glasgow, are equipping a factory with a 100-H.P. Diesel oil engine to drive the electric generating plant. Messrs. Anderson & Munro, Ltd., Glasgow, have a considerable amount of work on the domestic side of electric power. The Electric Control, Ltd., have shipped abroad a large number of automatic lift controllers of all types. The automatic control gear, with special speed-regulating and unloading devices, is being supplied to the Admiralty and to shipbuilding firms for the economical control of compressed air plants. Messrs. Frederick Braby & Co., Ltd., Glasgow, have had their electric-welding department working at the highest pressure. They turn out large quantities of large steel-riveted and welded cylinders, cisterns and tanks for oil, petrol, and other purposes. Sir William Arrol & Co., Glasgow, have a considerable amount of work in hand at their crane works, Parkhead. Messrs. Brown Brothers & Co., Ltd., Edinburgh, have an extensive order department for their steering gears, particular attention being given to the electro-hydraulic type. In the textile engineering trade electricity is being introduced in various ways in connection with improvements in detail of spinning and weaving machinery. One of the most recent is the electric rove-stop motion for the spinning frame. Demonstrations in Dundee have been very satisfactory, and the apparatus is now seen in several of the Dundee mills."

LIGHTING and POWER NOTES.

Accrington.—At a meeting of the Electricity Committee it was reported that the L.G.B. had sanctioned the borrowing of £300, repayable within 30 years, for the erection of the Clayton-le-Moors electrical sub-station.

The question of adopting an improved system of lighting in the Accrington Market is to be gone into by the Town Hall and Market Sub-Committee in consultation with the electrical engineer.

The B. of T. has consented to the scheme of overhead street lighting and wiring, subject to the work being in accordance with regulations, the Board reserving the right to review at the end of five years. The electrical engineer reports that the gas-making plant is almost complete. Last week the plant was run 10 hours daily under full-load conditions with not one involuntary stop, and all indications point to a successful issue of the installation.

Batley.—Very active opposition is being displayed against the proposals of the Corporation Electricity Committee to expend £16,000 in extensions to the electricity works, and the controversy is arousing considerable interest in the heavy woollen district. Ald. Blackburn, one of the opponents, maintains that the advocates of extension, upon their own estimates, if they spend £16,000 on new steam generating plant cannot hope to reduce their bare generating costs to less than 0·583d. per unit, exclusive of management, distribution, interest, depreciation and sinking fund charges.

Bath.—A L.G.B. inquiry has been held into an application by the Corporation to borrow £8,000—£3,000 for extension to Weston (being part of the added area under the boundaries extension scheme) and £5,000 for prospective expenditure in the next three years—in respect of the city's electrical undertaking. The application was stoutly opposed by the Bath Gas Light and Coke Co. The town clerk, replying to the criticisms of counsel, pointed out various directions in which the undertaking was hampered, and he trusted the Inspector would report to the L.G.B.

that the undertaking was suffering from certain serious disadvantages, that they were entitled to sympathy, that they had struggled for a long period against adverse circumstances, and when substantial loans matured they hoped to be able to put into the pockets of the ratepayers some dividend.

The E.L. Committee has decided to recommend the Council to accept from the Diesel Engine Co., Ltd., the engine supplied, as one of 340 KW. (instead of 450 KW. as originally contemplated), at the cost of £4,240, instead of the original price of £5,451, the company also paying the Corporation the sum of £1,730 as compensation for the delay which has taken place, and for the loss of economies resulting from the reduction of capacity. The Council is also recommended to apply to the L.G.B. for the necessary modification of consent to borrow, which has been issued for the sum of £7,500 and will be now required only for the sum of £6,289, covering cost of engine, auxiliaries, foundations and fixing.

Belfast.—An influential deputation representing large ratepayers attended before the T.C. last week in connection with the proposed extension of the Corporation's generating plant. A memorial was presented asking that the matter should be delayed, partly because the present time was unfavourable for borrowing large sums of money, and partly because the rapid development of the Diesel engine might, in a year or two, enable the Corporation to effect substantial savings if it were adopted. It was pointed out that Messrs. Harland & Wolff were taking a great interest in the Diesel engine, and that their view of its future could not be ignored. The chairman promised to give the matter full consideration.

Bridlington.—The Overseers have decided to ask the B. of G. to call in the services of an expert to reassess the undertakings of the Bridlington T.C., including the electricity works.

Continental Notes.—GERMANY.—The Newmark Electrical Union (Elektricitäts-Verband Neumark) will have, on the 1st of the current year, no fewer than 62 localities connected to its high-pressure distribution system in the province of Brandenburg. —*Elektro. Zeitschrift.*

A union of municipal electricity undertakings in Saxony has lately been formed in Dresden. Among its objects are (1) the maintenance of municipal ownership; (2) to endeavour to prevent monopolies being secured by private capital; and (3) the establishment of a joint purchasing office.

NORWAY.—The municipal authorities of Christiania have decided to develop the water power of the Hallfred-Sollberg Falls, situated some 40 km. from that city. Their capacity is equal to 27,000 H.P. The installation costs, including that of the long-distance mains, are estimated at 11,000,000 marks. In connection with this departure the T.C. intends to disburse a sum of 1,750,000 marks in the extension of the equipment of the municipal power station, including the acquisition of two three-phase turbo-generators of 5,000 and 6,000 KW. each.

BELGIUM.—Two new engines and dynamos, each of 2,000-KW. capacity, have recently been added to the central station of the Société d'Electricité du Brabant, at Oisquereq. The company has now secured the concession for the supply of current to 15 small towns and villages in the district, its power station having a capacity of 6,000 KW.

Conway.—At a meeting of the Lighting Committee the question of electric lighting came up for consideration, and it was decided, before adopting any particular scheme, to inspect the electrical plant at the Oakwood Park Hotel.

Cromer.—At a ratepayers' meeting on Friday, convened by opponents of the proposed transfer of the electric light undertaking by the U.D.C., there was a majority of 53 against the proposal. The votes registered numbered 133, three of which were invalid.

Cuckfield (Sussex).—Subject to certain stipulations, the U.D.C. has decided to give its consent to the prov. order for electric supply being applied for by the Mid-Sussex Electric Light Co.

Dartford.—A supply is to be given Messrs. Vickers, Ltd., at their works at Crayford, over the light railway cables, at a charge of 1d. per unit for a guaranteed consumption of 100,000 units per annum.

Dewsbury.—The Corporation has come to an arrangement with the Yorkshire Electric Power Co. under which the latter agrees to give the supply of electricity for lighting purposes in Thornhill through the Corporation.

Eccles.—The L.G.B. has sanctioned the borrowing of £870 for the purposes of the electricity undertaking.

The Electricity Supply and Public Lighting Committee has decided to ask the Member for the Division to support the Sheffield Members of Parliament in the endeavour to re-instate in the House of Commons, Clause 83 of the Sheffield Corporation Bill, 1912, dealing with electrical fittings.

Hebburn and Felling.—The Northern Counties' Electricity Supply Co., Ltd., is seeking powers to purchase the electrical undertakings of the Hebburn and Felling U.D.Cs., which it is at present working under agreements.

Kettlewell (Yorks.).—The formation of a private company, composed of villagers and including the local postmaster and schoolmaster, at Kettlewell, a village high up in the Yorkshire Craven hills, adds one more to the growing list of small places which, for their lighting facilities, are jumping straight from the use of the primitive oil to electricity. Amongst these places the Craven district already contributes Ingleton, Grassington, Clapham and Horton-in-Ribblesdale. In the case of Kettlewell a capital of £625 has been gathered by the company. As is usual in such places the village stream is to be harnessed as the means of generating current.

London.—WOOLWICH.—The Electricity Committee reports having considered the desirability of arranging reciprocal supplies with adjoining electricity supply undertakers, in order that applicants in outlying districts of the borough and also in adjoining areas may be supplied at a minimum of cost to the undertakers concerned in the laying of feeders, &c. To carry out this proposal, it has been decided to make application to the B. of T. for its permission to give and take a bulk supply from the West Kent Electric Co., and for a give-and-take supply from the South Metropolitan Electric Light and Power Co. £19,000 is to be borrowed on account of carrying out extensions at the Globe Lane works.

Northwich.—The R.D.C. has consented to the application to the B. of T., by the Weaverham Electricity Supply Co., for a prov. order for electric supply within the Council's area.

Nottingham.—Some time ago we referred to the proposal by a member of the Corporation, that expert advice should be obtained as to the hydro-electric possibilities of the Trent near the city. In the result, Mr. E. W. Monkhouse has now reported on the proposal, showing that to equip plants at Beeston and Colwick weirs would cost £52,869; that these plants, working at 61 per cent. load factor, should yield a profit of over £12,000, but if working at 22 per cent. load factor a loss of £191—while a modern steam station at the same capital cost and 22 per cent. load factor would yield a profit of about £9,000 per annum.

Taking into account the uncertainty of the hydraulic conditions and other circumstances, Mr. Monkhouse considers that the Corporation would be well advised to give up the idea of utilising the Trent and to utilise modern steam plant.

In view of the extraordinary ideas as to water power which prevail, it is interesting to note that Mr. Monkhouse finds that 160 B.H.P. can be obtained from the Trent at Beeston and 180 B.H.P. at Colwick, at low water; the power increases to a certain point with higher water and then decreases to nothing as the weirs are "drowned."

Nova Scotia.—According to the *Financier*, steps are being taken to develop the local River Mersey, from which it is estimated that about 30,000 H.P. can be obtained. Four power plants already exist in the lower reaches, and it is now proposed to raise the level of First Lake some 20 ft. and build three other dams at intervals, with a view to making further use of the water power.

Oldham.—The Electricity Committee has had under consideration a report by Mr. Newington, the engineer, embodying proposals for an extension of the plant which has become necessary owing to the exceptional increase this year in the maximum demand for lighting and power purposes, and to an application having been received from two mills for a supply of energy for power purposes, requiring in all about 800 or 900 H.P., or, say, 650 KW. The engineer recommends the immediate installation of one turbo-alternator of 1,500 KW., and two motor alternators of 500 KW. each, together with the necessary condensing plant, switchboards, foundations, &c., and one additional motor-driven pump for raising the water to the cooling towers, at a cost estimated in round figures at £13,000. The Committee decided to recommend that application be made to the L.G.B. for sanction to borrow £30,000, which is made up as follows:—Additional plant at the station, £13,000; mains, £9,500; transformers and switchgear, £1,200; future mains, £5,000; future transformers, £1,300.

Reigate.—The T.C. has decided to extend the lighting mains to the Reigate Lodge estate, which is being developed, on condition that current is used for all the public lighting there.

St. Helens.—The Electricity Committee of the T.C. has decided to supply current for heating purposes at 1d. per unit.

South Africa.—Two more sets of turbines and generators, each of 10,000 KW. capacity, have just been completed by the A.E.G., of Berlin, at the Vereeniging station of the Victoria Falls and Transvaal Power Co.; two additional 12,000 KW. sets are nearly ready, and when completed the capacity of this station alone will be about 70,000 H.P. The total generating capacity of all the stations erected and equipped by the A.E.G. for the Victoria Falls and Transvaal Power Co. will then be no less than 230,000 H.P.

South Africa.—The Durban Corporation is proposing to spend £176,000 on electrical construction and plant during the year. Electric lighting schemes are being promoted in Ladybrand, Somerset West, and Umtali (Rhodesia), and an extension of the town supply to adjoining areas at Pretoria.—*South African Export Gazette.*

Tilbury.—The U.D.C. has now given its consent to the application of the County of London Electric Supply Co., Ltd., for a prov. order for electric supply.

Tyldesley.—The Power Co., which holds the rights of supply of electricity in the township, has made arrangements with the Tramways Co. to give it a supply of current in bulk, and a plot of land in Castle Street has been taken for the erection of a transformer station.

Turton (near Bolton).—The U.D.C. has agreed to the Lancashire Electric Power Co. laying a trunk main cable from Horrobin Mill to Belmont Bleachworks.

Wakefield.—A Committee of the West Riding C.C. has accepted the offer of the Wakefield Corporation to supply electricity for the County Offices and adjacent offices, at the current rate for the time being, provided the rate does not exceed 4d. per unit, and subject to a discount of 11 per cent. Consideration had been given to a scheme for the C.C. to generate the electricity needed.

York.—A recent debate in the York City Council on the proposed purchase of the Gas Co.'s undertaking is of more than usual interest, as the leading advocates of this purchase are the chairman, vice-chairman and other members of the Electricity Committee. We cannot pretend to understand the reason for their attitude, as the electricity supply department will be the loser by the stifling of competition which naturally follows when both electric and gas supplies are controlled by the Corporation. Moreover, there is every indication that the price of electricity can and will be greatly reduced in the near future, and that the prospects of competing gas undertakings will be correspondingly affected—this being already apparent in some localities.

The manager having reported that he can undertake the electrification of the proposed tramways extension at a saving of £353 on the lowest tender received, the Committee has decided to recommend the Corporation that the work be carried out by its own staff.

TRAMWAY and RAILWAY NOTES.

Argentina.—The Buenos Ayres correspondent of the *Daily Telegraph* writes as follows:—"There is a startling sequel to the recent decision in the injunction proceedings of the Anglo-Argentine Tramways Co. *v.* the Metropolitan Railway, which were decided in favour of the plaintiffs, on grounds that permission was never given to the defendants to make tunnels, and that the municipality so certified. The Metropolitan Railway now produces a certificate of Intendente Guiraldez, showing a decree of Intendente Bullrich in 1901 authorising the tunnelling; and also correspondence with the Director of Public Works referring to the opening of shafts. Evidently a serious mistake has been made, and the vexed question as to who owns the real right to construct underground lines is still undecided."

Australia.—According to the *Financier*, the New South Wales Minister for Works announces that steps will be immediately taken to put into operation a portion of the scheme drafted by Mr. Hay, for dealing with Sydney's traffic. It is proposed to carry out the first section of the city underground railway, at a cost of between £250,000 and £300,000. In view of the completeness of Mr. Hay's report upon Sydney's traffic problem, the Minister considers a reference to the Works Committee unnecessary, and proposes to introduce a short enabling Bill in Parliament in lieu thereof, which will effect a considerable saving of time and money.

Bristol.—At the last meeting of the C.C. the question was debated as to the desirability of tramway purchase by the municipality. After some discussion, a committee was appointed to deal specially with the matter, and to report as to the desirability or otherwise of exercising the option vested in the Corporation of purchasing the tramway undertaking within the city.

Barton-upon-Irwell.—The Board of Guardians has decided to approve the recommendation of the Assessment Committee to appear as respondents in the appeal of the Salford Corporation Tramways Committee against the present valuation and assessment of the tramways in the Eccles and Swinton areas. Mr. Everett (chairman of the Assessment Committee) said there had been several objections by Salford during the past two or three years as to the amount of the tramways assessment, and last year a temporary arrangement was arrived at involving considerable loss to the rates. There had been conferences with the Salford Tramways Committee, and the town clerk had formulated a new scheme that all tramways ought to be valued for assessment on the parochial system, *i.e.*, a method whereby inspectors take a special census of the tickets issued to and from the localities concerned, and then it is decided what proportionate value of such tickets is due to Swinton and Eccles. This had been done on a given day by the tramways authority, and on the basis of that result they were appealing against the assessment. Barton Union covers an area through which three tramway authorities have running powers, and the point at issue is a very important one for both rating authorities and tramway committees.

Clayton-le-Moors.—There has been a good deal of talk in the Clayton-le-Moors district of Lancashire about a scheme for the construction of a light railway connecting Clayton with the Lancashire and Yorkshire Co.'s main line between Accrington and Huncoat, but the railway company (who agreed, after the scheme had been set on foot locally, to take the project over and secure the necessary Parliamentary powers) have now intimated that owing to "financial and other considerations" there is no immediate prospect of the construction of the line.

Cuba.—La Sociedad Tranvias de Matanza has secured a concession for the construction and working of an electric tramway—on the overhead trolley system—in the town of Matanza.

Continental Notes.—France.—A new company has lately been formed at Bayonne, with a capital of £40,000, and the title La Compagnie des Tramways Electriques de la Ville de Bayonne.

Italy.—La Società Tranviaria Elettrica Littoranea Viareggio-Versilia has entered into an arrangement with the municipal authorities of Carrara for the construction and working of an electric tramway to connect the town of Carrara with the seacoast. A scheme for the construction of an electric tramway between Viareggio and Carrara is also at present under consideration.

The proposed conversion to electric traction of the railway between Napoli Pozznoli and Torre Gaveto, with the doubling of the track between Terme and Fuorigrotta, has received Government sanction.—*Giornale dei Lavori Pubblici.*

Switzerland.—A company has lately been formed in Andermatt with a capital of £48,000, and the title Die Schollenenbahn Gesellschaft, to construct and work an electric railway between Schollenen and Goschenen.

The Berner Alpen Railway authorities, who are electrifying their Lotschberg section, are reported to have placed orders with the Oerlikon Co. and with Messrs. Brown, Boveri & Co., of Baden, for the electrical equipment for 12 2,500-H.P. electric locomotives.

Hungary.—Plans have been completed for the construction of an electric railway between Czinkota and Ratoszliget for the Budapest Local Railway Co. The work is expected to be commenced in the spring.

Russia.—According to the local Press, the Commission for New Railways has approved the project for an electric railway from Riga to Riga Strand, subject, however, to the assent of the Riga Municipality being obtained. This condition was inserted because a section of the proposed line would run through the suburbs of the town.—*Board of Trade Journal.*

Germany.—An electrically-operated ventilating installation is being carried out at the Kaiser Wilhelm railway tunnel near Treves. A shaft is being sunk from the mountain top to the centre of the tunnel, which is described as being the longest in Germany. The plant, which will be of several hundred horse-power, will be located on the mountain, and will draw the foul air from the tunnel up the shaft. The necessary electrical energy for the plant is to be supplied from the Treves Municipal electric lighting station.

Eccles.—A deputation has been appointed to meet the Salford Tramway Committee with a view to discussion of the terms of future supply to avoid, if possible, the costs of an arbitration.

Halifax.—The Corporation Parliamentary Bill, which has been issued in printed form to the members of the Council, includes application for borrowing powers for tramways, amounting to £147,738, for electrical equipment and other works in connection with the said tramways, £25,000; and rolling stock, £22,200. The most important clause in the Bill provides that notwithstanding anything to the contrary in Sec. 43 of the Tramways Act, 1870, a local authority shall not purchase the tramways in its district before the expiration of 31 years from the passing of this Act. The tramways embodied in the Act are to be completed within five years, and the Corporation's powers shall then lapse. In the case of Brighouse, it is agreed between the Halifax and Brighouse Corporations, that the extension to Rastrick shall be carried out within 18 months. Agreements are set out in the schedules of the Bill with Brighouse, Soyland, Stainland, Greetland, the Halifax Rural District Council, Shelf, Sowerby Bridge, and Hipperholme, but not with Hebden Bridge or Elland.

Lancs. and Yorks. Electrical Lines.—The newly-electrified (H.T., D.C.) line between Bury and Holcombe Brook is expected to be completed in the course of the next month.

Liverpool.—Another remarkable increase is shown in the Corporation tramway receipts for 1912. The full returns are not yet published, but from January 1st to December 28th the receipts amounted to £625,163, an increase over 1911 (which was a record) of £26,977. The passengers carried numbered 133,228,898, as against 128,206,669, an increase of 5,022,229. The mileage in 1912 was 12,496,300, being an increase of 141,968 miles as compared with 1911.

London.—With a view to facilitating the loading and unloading of the trains during rush hours, the Piccadilly Tube authorities have been experimenting with systems of centre doorways on the coaches, and have apparently satisfied themselves as to the merits of a type of double swing door, with electrical indicating lamps, to show when shut or open, on the conductors' and drivers' platforms. If the arrangement is adopted it is assumed that the other Tube lines will take it up.

Manchester.—The question of the provision of light glass shelters over the pathways at the principal car-stopping places in the city is to be brought before the City Council, with a view to securing the consideration of the Tramways Committee.

Nelson.—At the T.C. on January 2nd the chairman of the Tramways Committee said that he and the tramways manager discussed recently the question of providing a double track between the centre and Hildrop Road. A lot of time was lost through cars having to wait on the loop, and people could walk the length in the time.

Rotherham.—The Parliamentary Committee reports having had under consideration the proposal of the Mexboro' and Swinton Tramways Co., to apply for powers to run trolley vehicles in certain districts adjoining the town. The Committee has decided

to obtain from the company an undertaking that if, in the event of the Corporation not opposing its application to run trolley vehicles to Conisburgh, it will agree, if the Corporation applies for powers to run trolley vehicles to the same place, not to oppose the proposal of the Corporation.

Sheffield.—The Joint Sub-Committee of representatives of the Tramways and Electric Light Committees has issued its report as to whether, in connection with providing an additional supply of energy for the tramways, the two separate generating stations at Kelham Island and Neepsend should continue to be extended on different systems, entirely isolated, so that the tramways could not obtain any assistance from the large Neepsend station, or matters should be so arranged that these two large supply stations would both be available for supplying energy to the tramways. After going into the matter fully, the Sub-Committee recommends:—(1) That it is not advisable to continue to develop the Kelham Island power station as a separate and isolated unit, but that it is advisable to take steps at once to connect the two stations and install converting plant at Kelham Island; and that a supply of energy be taken as and when thought necessary and advisable by the tramways department from the Neepsend station, by which means both stations will in future be available for the supply of energy to the tramways; (2) that two 1,500-KW. converter sets be put down at Kelham Island as early as possible to deal with the power supply from the Neepsend station; (3) that the prices and conditions which the electric supply department offer for this purpose be adopted. [The charge is based on £4 per KW. per annum plus ·25d. per unit supplied, and ranges from ·615d., 30 per cent. L.F., to ·360d. 100 per cent. L.F.] (4) That tenders be obtained for the necessary plant, &c., for the carrying out of the arrangements. In arriving at its decision the Sub-Committee states that whilst the supply from Kelham station has been regularly maintained at a low working cost, the tramways had developed on larger lines than was originally expected when the Kelham site was decided upon and plant first installed there. The position of the Kelham station is such that there must always be a considerable handicap attached to the working of the station. The Neepsend site and station has been developed on larger lines as a result of more modern experience gained during recent years, and can now supply and provide in the future the additional power required for the tramways.

It has been decided by the Tramways Committee, by resolution, to recommend the grant of £2,000 from the special purposes fund of the tramways, towards the cost of the extension buildings in connection with the Applied Science Department of the Sheffield University. The decision to make the grant is the outcome of a letter from Sir Joseph Jonas to Sir Wm. Clegg, in which Sir Joseph stated that the efforts to obtain from the Treasury a special grant had been unsuccessful, and it was therefore necessary to raise what was required from other sources. The total sum required is £12,000, and this amount Sir Joseph has set out to obtain.

Siam.—It is reported that La Compagnie Mutuelle de Tramways, of Brussels, is negotiating the formation of a large new company to undertake the establishment of an electricity station in Bangkok for the supply of current for lighting and power purposes, and for tramway operation in the Siamese capital.

South Africa.—According to the *South African Export Gazette*, the Durban Corporation has decided to spend £150,000 on tramway extensions; the extension of the Pretoria municipal area will involve further tramway construction; the Krugersdorp Council, although considering the preliminary use of petrol-electric buses, has earmarked £45,000 for a future tramway scheme.

U.S.A.—According to the *Financial News*, the beginning of the electrification of the trans-Continental railways is marked by the grant to the Great Falls (Montana) Power Co. of permission to transmit power for the electrification of 450 miles of track on the main line of the Chicago, Milwaukee and Puget Sound Railway between two points in Montana and Idaho.

Warrington.—The Electricity and Tramways Committee has decided that the tramways manager prepare a map showing the existing tramways and his suggestions for new routes for the proposed motor-omnibuses, and that a copy thereof be supplied to each member of the Committee.

TELEGRAPH and TELEPHONE NOTES.

Brazil.—The Brazilian Government has concluded an important contract with Marconi's Wireless Telegraph Co. for the provision of powerful stations at Rio de Janeiro, Santa Martha, Bauru, and Ladario, the two last-named being important towns in the Sao Paulo and Matto Grosso regions. These stations will form the Southern nucleus of the Brazilian internal wireless network first proposed by Dr. Bhering, the delegate of the Brazilian Government to the recent London Radiotelegraphic Conference. In all, not fewer than 30 such wireless stations will be required for the main lines of Dr. Bhering's scheme to be realised, and the Marconi Co.'s success in obtaining the contract for the four stations now to be erected in the South is the result of the very satisfactory working of the Manaos and Porto Velho stations which form the Northern nucleus of the general scheme. These stations are situated in the tropics on the Amazon River, where severe electrical storms are almost continuously experienced.

France.—The French Post and Telegraph authorities have decided on the establishment of a large new telephone exchange in Paris, on the site of part of the old Cherche Midi Military Prison.

Japan.—Some difficulty is being experienced by the Japanese telegraph service owing to the damage caused to the submarine cables off the coast of Japan by fishing trawlers. Owing to the profitable nature of the business, there has recently been a large increase in the number of trawlers, with the result that an interruption of the cable service is frequently caused. The authorities of the Government Telegraphs and Agriculture Departments are at present conferring as to the steps to be taken to overcome the difficulty.

Persia.—The Minister of Posts and Telegraphs has authorised the Indo-European Telegraph Department to reconstruct the Arabistan telegraph lines with iron poles. The result will be to ensure reliable international telegraphic communication with such places as Ahwaz, Shusta and Mohamerah. All the existing concessions of the Department have been renewed until 1945.

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The Wellington and Auckland exchanges are nearing the limit of their capacity, and the Minister of Post and Telegraphs has announced that tenders are to be called immediately for automatic exchange apparatus to be so constructed that it can be used in conjunction with the existing magneto system. The chief electrician of the Department made an extended tour recently through the United States, England and the Continent, and has reported very favourably on automatic systems generally. The Strowger Co. erected a demonstration board of about 20 lines in Wellington, and this has been in operation for several months with satisfactory results. The growth of several of the smaller towns is proceeding at such a rapid rate that there is a probability of several of them also being served on the automatic or semi-automatic systems.

South Africa.—Telephone developments to cost £8,000 are contemplated at Durban.—*British and South African Export Gazette.*

The Imperial Wireless System.—On Wednesday, January 1st, the Select Committee of the House of Commons resumed the inquiry into the Marconi contract. Major Archer-Shee, M.P., gave evidence, repeating his contention that the Marconi Co. had received special consideration from the Post Office, and stigmatising as a monstrosity the clause which bound the Government for five years to adhere to the Marconi system (the clause has been dropped). If the Marconi Co. received £60,000 a year from the royalty, he said they would be able to buy up rival patents. He suggested that the agreement of 1909 gave the Postmaster-General power to use any Marconi patent, and said that the Government should invite tenders, and have the stations built under their own control. He had been offered shares in the Poulsen Syndicate in 1911, and again last year, but refused them, being interested in a State-owned Atlantic cable. Mr. Gandil, who represented the Danish owners of the patents, had informed him of the way in which the Post Office had dealt with the offer of the Poulsen Co. He had no interest in any wireless company. The speed of transmission contracted for was totally inadequate. The Poulsen Co. had proved that they could send messages over 2,000 miles at a speed exceeding 100 words a minute. Other systems were, or soon would be, capable of sending at the same rate. The speed contracted for should be subject to revision after five years. In December, 1911, by trial he found that the Marconi trans-Atlantic service took three times as long as the cable to transmit a message; but on December 30th, 1912, it got through much more quickly. In his opinion, the cable system was more efficient, but wireless would be a most valuable auxiliary. He suggested that the Committee should present an interim report, recommending that the acquisition of sites and the erection of buildings should be proceeded with immediately, while the best system was selected at leisure by a technical Committee. Under the agreement the Marconi Co. would be able to create a great wireless trust.

Mr. Viggo Gandil, representing the owners of the Poulsen-Pedersen patents, said that early in 1911 he was forming a British company to work the system, and to establish a service between the United Kingdom and Canada. Learning in October, 1911, that an Imperial scheme was under consideration, he asked the Post Office for an opportunity to tender, and on January 11th, 1912, he voluntarily submitted an offer to build six stations for £40,000 per station, including the power house and foundations. For the wireless equipment alone of the Indian station he named a price of £22,000. On January 18th, 1912, he met the Postmaster-General, and offered to give a demonstration of wireless telegraphy across the Atlantic in six or, at most, eight months; he pointed out that it was impossible to raise capital for a wireless scheme without a guarantee that the Government would grant a licence, that the stations would not be liable to be acquired by Government on its own terms, and that the Government would not erect competing stations. On January 19th, on behalf of the Postmaster-General, Mr. Farnall asked if he would sell all the unsold Poulsen patent rights for the whole world, but he declined. He further offered, on January 29th, to build stations in Ireland, Cyprus and Canada, provided that if these were satisfactory the Government would adopt his system for the first six stations. On February 19th, the offer was refused. He was then in touch

Turton (near Bolton).—The U.D.C. has agreed to the Lancashire Electric Power Co. laying a trunk main cable from Horrobin Mill to Belmont Bleachworks.

Wakefield.—A Committee of the West Riding C.C. has accepted the offer of the Wakefield Corporation to supply electricity for the County Offices and adjacent offices, at the current rate for the time being, provided the rate does not exceed 4d. per unit, and subject to a discount of 11 per cent. Consideration had been given to a scheme for the C.C. to generate the electricity needed.

York.—A recent debate in the York City Council on the proposed purchase of the Gas Co.'s undertaking is of more than usual interest, as the leading advocates of this purchase are the chairman, vice-chairman and other members of the Electricity Committee. We cannot pretend to understand the reason for their attitude, as the electricity supply department will be the loser by the stifling of competition which naturally follows when both electric and gas supplies are controlled by the Corporation. Moreover, there is every indication that the price of electricity can and will be greatly reduced in the near future, and that the prospects of competing gas undertakings will be correspondingly affected—this being already apparent in some localities.

The manager having reported that he can undertake the electrification of the proposed tramways extension at a saving of £353 on the lowest tender received, the Committee has decided to recommend the Corporation that the work be carried out by its own staff.

TRAMWAY and RAILWAY NOTES.

Argentina.—The Buenos Ayres correspondent of the *Daily Telegraph* writes as follows:—"There is a startling sequel to the recent decision in the injunction proceedings of the Anglo-Argentine Tramways Co. *v.* the Metropolitan Railway, which were decided in favour of the plaintiffs, on grounds that permission was never given to the defendants to make tunnels, and that the municipality so certified. The Metropolitan Railway now produces a certificate of Intendente Guiraldez, showing a decree of Intendente Bullrich in 1901 authorising the tunnelling; and also correspondence with the Director of Public Works referring to the opening of shafts. Evidently a serious mistake has been made, and the vexed question as to who owns the real right to construct underground lines is still undecided."

Australia.—According to the *Financier*, the New South Wales Minister for Works announces that steps will be immediately taken to put into operation a portion of the scheme drafted by Mr. Hay, for dealing with Sydney's traffic. It is proposed to carry out the first section of the city underground railway, at a cost of between £250,000 and £300,000. In view of the completeness of Mr. Hay's report upon Sydney's traffic problem, the Minister considers a reference to the Works Committee unnecessary, and proposes to introduce a short enabling Bill in Parliament in lieu thereof, which will effect a considerable saving of time and money.

Bristol.—At the last meeting of the C.C. the question was debated as to the desirability of tramway purchase by the municipality. After some discussion, a committee was appointed to deal specially with the matter, and to report as to the desirability or otherwise of exercising the option vested in the Corporation of purchasing the tramway undertaking within the city.

Barton-upon-Irwell.—The Board of Guardians has decided to approve the recommendation of the Assessment Committee to appear as respondents in the appeal of the Salford Corporation Tramways Committee against the present valuation and assessment of the tramways in the Eccles and Swinton areas. Mr. Everett (chairman of the Assessment Committee) said there had been several objections by Salford during the past two or three years as to the amount of the tramways assessment, and last year a temporary arrangement was arrived at involving considerable loss to the rates. There had been conferences with the Salford Tramways Committee, and the town clerk had formulated a new scheme that all tramways ought to be valued for assessment on the parochial system, *i.e.*, a method whereby inspectors take a special census of the tickets issued to and from the localities concerned, and then it is decided what proportionate value of such tickets is due to Swinton and Eccles. This had been done on a given day by the tramways authority, and on the basis of that result they were appealing against the assessment. Barton Union covers an area through which three tramway authorities have running powers, and the point at issue is a very important one for both rating authorities and tramway committees.

Clayton-le-Moors.—There has been a good deal of talk in the Clayton-le-Moors district of Lancashire about a scheme for the construction of a light railway connecting Clayton with the Lancashire and Yorkshire Co.'s main line between Accrington and Huncoat, but the railway company (who agreed, after the scheme had been set on foot locally, to take the project over and secure the necessary Parliamentary powers) have now intimated that owing to "financial and other considerations" there is no immediate prospect of the construction of the line.

Cuba.—La Sociedad Tranvias de Matanza has secured a concession for the construction and working of an electric tramway—on the overhead trolley system—in the town of Matanza.

Continental Notes.—FRANCE.—A new company has lately been formed at Bayonne, with a capital of £40,000, and the title La Compagnie des Tramways Electriques de la Ville de Bayonne.

ITALY.—La Società Tranviaria Elettrica Littoranea Viareggio-Versilia has entered into an arrangement with the municipal authorities of Carrara for the construction and working of an electric tramway to connect the town of Carrara with the seacoast. A scheme for the construction of an electric tramway between Viareggio and Carrara is also at present under consideration.

The proposed conversion to electric traction of the railway between Napoli Pozzuoli and Torre Gaveto, with the doubling of the track between Terme and Fuorigrotta, has received Government sanction.—*Giornale dei Lavori Pubblici.*

SWITZERLAND.—A company has lately been formed in Andermatt with a capital of £48,000, and the title Die Schollenenbahn Gesellschaft, to construct and work an electric railway between Schollenen and Goschenen.

The Berner Alpen Railway authorities, who are electrifying their Lotschberg section, are reported to have placed orders with the Oerlikon Co. and with Messrs. Brown, Boveri & Co., of Baden, for the electrical equipment for 12 2,500-H.P. electric locomotives.

HUNGARY.—Plans have been completed for the construction of an electric railway between Czinkota and Ratosliget for the Budapest Local Railway Co. The work is expected to be commenced in the spring.

RUSSIA.—According to the local Press, the Commission for New Railways has approved the project for an electric railway from Riga to Riga Strand, subject, however, to the assent of the Riga Municipality being obtained. This condition was inserted because a section of the proposed line would run through the suburbs of the town.—*Board of Trade Journal.*

GERMANY.—An electrically-operated ventilating installation is being carried out at the Kaiser Wilhelm railway tunnel near Treves. A shaft is being sunk from the mountain top to the centre of the tunnel, which is described as being the longest in Germany. The plant, which will be of several hundred horse-power, will be located on the mountain, and will draw the foul air from the tunnel up the shaft. The necessary electrical energy for the plant is to be supplied from the Treves Municipal electric lighting station.

Eccles.—A deputation has been appointed to meet the Salford Tramway Committee with a view to discussion of the terms of future supply to avoid, if possible, the costs of an arbitration.

Halifax.—The Corporation Parliamentary Bill, which has been issued in printed form to the members of the Council, includes application for borrowing powers for tramways, amounting to £147,738, for electrical equipment and other works in connection with the said tramways, £25,000; and rolling stock, £22,200. The most important clause in the Bill provides that notwithstanding anything to the contrary in Sec. 43 of the Tramways Act, 1870, a local authority shall not purchase the tramways in its district before the expiration of 31 years from the passing of this Act. The tramways embodied in the Act are to be completed within five years, and the Corporation's powers shall then lapse. In the case of Brighouse, it is agreed between the Halifax and Brighouse Corporations, that the extension to Rastrick shall be carried out within 18 months. Agreements are set out in the schedules of the Bill with Brighouse, Soyland, Stainland, Greetland, the Halifax Rural District Council, Shelf, Sowerby Bridge, and Hipperholme, but not with Hebden Bridge or Elland.

Lancs. and Yorks. Electrical Lines.—The newly-electrified (H.T., D.C.) line between Bury and Holcombe Brook is expected to be completed in the course of the next month.

Liverpool.—Another remarkable increase is shown in the Corporation tramway receipts for 1912. The full returns are not yet published, but from January 1st to December 28th the receipts amounted to £625,163, an increase over 1911 (which was a record) of £26,977. The passengers carried numbered 133,228,898, as against 128,206,669, an increase of 5,022,229. The mileage in 1912 was 12,496,300, being an increase of 141,968 miles as compared with 1911.

London.—With a view to facilitating the loading and unloading of the trains during rush hours, the Piccadilly Tube authorities have been experimenting with systems of centre doorways on the coaches, and have apparently satisfied themselves as to the merits of a type of double swing door, with electrical indicating lamps, to show when shut or open, on the conductors' and drivers' platforms. If the arrangement is adopted it is assumed that the other Tube lines will take it up.

Manchester.—The question of the provision of light glass shelters over the pathways at the principal car-stopping places in the city is to be brought before the City Council, with a view to securing the consideration of the Tramways Committee.

Nelson.—At the T.C. on January 2nd the chairman of the Tramways Committee said that he and the tramways manager discussed recently the question of providing a double track between the centre and Hildrop Road. A lot of time was lost through cars having to wait on the loop, and people could walk the length in the time.

Rotherham.—The Parliamentary Committee reports having had under consideration the proposal of the Mexboro' and Swinton Tramways Co., to apply for powers to run trolley vehicles in certain districts adjoining the town. The Committee has decided

to obtain from the company an undertaking that if, in the event of the Corporation not opposing its application to run trolley vehicles to Conisburgh, it will agree, if the Corporation applies for powers to run trolley vehicles to the same place, not to oppose the proposal of the Corporation.

Sheffield.—The Joint Sub-Committee of representatives of the Tramways and Electric Light Committees has issued its report as to whether, in connection with providing an additional supply of energy for the tramways, the two separate generating stations at Kelham Island and Neepsend should continue to be extended on different systems, entirely isolated, so that the tramways could not obtain any assistance from the large Neepsend station, or matters should be so arranged that these two large supply stations would both be available for supplying energy to the tramways. After going into the matter fully, the Sub-Committee recommends:—(1) That it is not advisable to continue to develop the Kelham Island power station as a separate and isolated unit, but that it is advisable to take steps at once to connect the two stations and install converting plant at Kelham Island; and that a supply of energy be taken as and when thought necessary and advisable by the tramways department from the Neepsend station, by which means both stations will in future be available for the supply of energy to the tramways; (2) that two 1,500-KW. converter sets be put down at Kelham Island as early as possible to deal with the power supply from the Neepsend station; (3) that the prices and conditions which the electric supply department offer for this purpose be adopted. [The charge is based on £4 per KW. per annum plus ·25d. per unit supplied, and ranges from ·615d., 30 per cent. L.F., to ·360d. 100 per cent. L.F.] (4) That tenders be obtained for the necessary plant, &c., for the carrying out of the arrangements. In arriving at its decision the Sub-Committee states that whilst the supply from Kelham station has been regularly maintained at a low working cost, the tramways had developed on larger lines than was originally expected when the Kelham site was decided upon and plant first installed there. The position of the Kelham station is such that there must always be a considerable handicap attached to the working of the station. The Neepsend site and station has been developed on larger lines as a result of more modern experience gained during recent years, and can now supply and provide in the future the additional power required for the tramways.

It has been decided by the Tramways Committee, by resolution, to recommend the grant of £2,000 from the special purposes fund of the tramways, towards the cost of the extension buildings in connection with the Applied Science Department of the Sheffield University. The decision to make the grant is the outcome of a letter from Sir Joseph Jonas to Sir Wm. Clegg, in which Sir Joseph stated that the efforts to obtain from the Treasury a special grant had been unsuccessful, and it was therefore necessary to raise what was required from other sources. The total sum required is £12,000, and this amount Sir Joseph has set out to obtain.

Siam.—It is reported that La Compagnie Mutuelle de Tramways, of Brussels, is negotiating the formation of a large new company to undertake the establishment of an electricity station in Bangkok for the supply of current for lighting and power purposes, and for tramway operation in the Siamese capital.

South Africa.—According to the *South African Export Gazette*, the Durban Corporation has decided to spend £150,000 on tramway extensions; the extension of the Pretoria municipal area will involve further tramway construction; the Krugersdorp Council, although considering the preliminary use of petrol-electric buses, has earmarked £45,000 for a future tramway scheme.

U.S.A.—According to the *Financial News*, the beginning of the electrification of the trans-Continental railways is marked by the grant to the Great Falls (Montana) Power Co. of permission to transmit power for the electrification of 450 miles of track on the main line of the Chicago, Milwaukee and Puget Sound Railway between two points in Montana and Idaho.

Warrington.—The Electricity and Tramways Committee has decided that the tramways manager prepare a map showing the existing tramways and his suggestions for new routes for the proposed motor-omnibuses, and that a copy thereof be supplied to each member of the Committee.

TELEGRAPH and TELEPHONE NOTES.

Brazil.—The Brazilian Government has concluded an important contract with Marconi's Wireless Telegraph Co. for the provision of powerful stations at Rio de Janeiro, Santa Martha, Bauru, and Ladario, the two last-named being important towns in the Sao Paulo and Matto Grosso regions. These stations will form the Southern nucleus of the Brazilian internal wireless network first proposed by Dr. Bhering, the delegate of the Brazilian Government to the recent London Radiotelegraphic Conference. In all, not fewer than 30 such wireless stations will be required for the main lines of Dr. Bhering's scheme to be realised, and the Marconi Co.'s success in obtaining the contract for the four stations now to be erected in the South is the result of the very satisfactory working of the Manaos and Porto Velho stations which form the Northern nucleus of the general scheme. These stations are situated in the tropics on the Amazon River, where severe electrical storms are almost continuously experienced.

France.—The French Post and Telegraph authorities have decided on the establishment of a large new telephone exchange in Paris, on the site of part of the old Cherche Midi Military Prison.

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with financiers who could have provided funds to carry out the Imperial scheme, and had since formed a British company primarily for trans-Atlantic work; but it was always told him that nobody but Marconi would be allowed to do Government work. He had made it clear to the Postmaster-General in January, 1912, that if he were allowed to tender he could prove that he had the necessary financial support, and that he would ask for no payment from the Government unless the latter were satisfied with the stations. Dr. Poulsen and Prof. Pedersen were scientists of the highest eminence, and had a staff of experienced engineers; they had almost completed the designs for two trans-Atlantic stations for the Universal Radio Syndicate, Ltd., which was registered in September last, with £100,000 capital, and would own all the Poulsen rights except for Germany and the United States.

On Thursday Mr. Gandil was closely cross-examined on a statement which he had made to the effect that Sir Alex. King's assertion that he had been told by Government experts that the Poulsen Co. had not communicated, and never could communicate, over a distance of 2,000 miles need not be taken seriously, in view of the evidence of the experts themselves. He admitted that at the time they had no regular service over 2,000 miles, but had pointed out always that they undoubtedly could do it. He could not name any places between which his company was communicating regularly by day. The system could be tested between Honolulu and San Francisco. Sir Alex. King knew nothing about wireless; Mr. Madge and Mr. J. E. Taylor, the Government experts, had expressed the opinion that his company could do it. It was true that his company had not yet communicated over 2,000 miles, but the system had done it. At the time they could have taken a contract for six stations at £40,000 each. The syndicate was called the Continental Syndicate for Poulsen Radio-Telegraphy, with headquarters in Copenhagen, and it had the right by the contract of sale to all improvements made in America. He learnt from Sir W. Hall-Jones, the High Commissioner for New Zealand, that the stations were to be 2,000 miles apart, and that the Marconi Co. had not got the contract, before he wrote the letter of January 11th, 1912. He was not told by the Postmaster-General on January 18th that the conditions laid down by the Imperial Wireless Committee were a demonstration of working over 2,000 miles and a waiver of the restriction in communication with foreign countries; had he known, he could have given the demonstration within the time allowed, and would have seriously considered the question of the waiver.

He would have been prepared to erect the stations at a less cost than £60,000 each, and to guarantee that the system would work at high speed, at a lower working cost, and without reservation regarding atmospheric disturbances, as well as to guarantee financial ability to carry out the work, but he never had the opportunity to tender. There was no difficulty, to an engineer, in extending the range from 1,000 to 2,000 miles. They might be able to have the stations in Ireland and Canada at work in August, and could give a demonstration of practical working over 2,000 miles within six months. He had not heard until that day the conditions prescribed by the Committee.

The P.O. Telephone Staff.—Great dissatisfaction has arisen among the Post Office Telephone outside staff at Leeds, and the trouble threatens to become national. The allegations are that they have been deprived of "walking time," and can only earn 22s. per week, and that a system of espionage is permitted, with the result that men are dismissed without explanation.

Venezuela.—Owing to the frequent interruptions in the submarine telegraphic connections with Venezuela, the Government of that country, at the instance of the Chamber of Commerce of Caracas, has established a daily steamer service between the Port of Cristobal Colon (Macuro) and the Island of Trinidad, in order that cables for Venezuela may be transmitted to Trinidad and then conveyed by steamers to Venezuela, so ensuring a minimum of delay.

CONTRACTS OPEN and CLOSED.

OPEN

Atherton.—January 29th. One E.H.T. switchboard and one H.T. switchboard for the U.D.C. See "Official Notices" December 27th.

Australia.—VICTORIA.—January 28th. Paper-insulated lead-covered cable for the P.M.G.'s department. See "Official Notices" December 20th.

February 21st.—Four 1,500-KW. rotary converters, for the Melbourne City Council. See "Official Notices" December 6th.

WESTERN AUSTRALIA.—February 19th. Armoured telegraph cable, for the P.M.G.'s department. See "Official Notices" to-day.

Birmingham.—January 27th. Stores for a year for the Corporation Tramways. Mr. A. Baker, manager.

Bispham-with-Norbreck.—January 18th. One oil or gas engine direct coupled to a 100-KW. dynamo, for the U.D.C. See "Official Notices" January 3rd.

Canada.—January 24th. Chairman, Winnipeg Board of Control; three 2,700-KW. step-down transformers. Plans, &c., Civic Light and Power Department, Winnipeg. Tenders endorsed "Tender for step-down transformers."

February 13th.—Machines, motors, cranes, &c., for Transcona Railway shops. Specifications, forms of tender, Mr W. J. Press, engineer, Ottawa.

February 10th.—One 1,500-KW. steam turbine and generator for the City of Moose Jaw, Sask. See "Official Notices" to-day.

Chile.—September 10th. Tenders are invited for the establishment of an electric central station and the distribution of electrical energy at the port of Valparaiso. Inquire at the offices of the Chilean Legation, 48, Grosvenor Square, W.

Clacton-on-Sea.—January 29th. One 250-KW. Diesel oil engine, generator, switchboard, &c., for the U.D.C. See "Official Notices" to-day.

Eastbourne.—January 14th. One 1,000-KW. horizontal steam turbine and alternator, without condensing plant, for the Corporation. See "Official Notices" December 20th.

Glasgow.—January 21st. Two 6,000-KW. turbo-alternators, with condensing plant and accessories, and water-tube boilers, for the Corporation. See "Official Notices" January 3rd.

Harwich.—January 13th. Four motor-driven centrifugal pumps, two motor-driven sewage rakes and screens, with switchgear, and about 400 yd. of 15-in. cast-iron rising main, for the Corporation. See "Official Notices" December 20th.

India.—January 24th. Bombay, Baroda and Central India Railway invites tenders for rotary converter plant. See "Official Notices" to-day.

London.—STEPNEY.—The B.C. Electricity Committee is about to invite tenders for two 5,000-KW. turbo-alternators, four water-tube boilers, condensers, switchgear, &c.

L.C.C.—January 20th. Electrical installations at Camberwell School of Arts (with fire-alarm bells and wiring for power and electrical clocks), and at Vauxhall Street Elementary School. See "Official Notices" to-day.

Nelson.—February 3rd. One traction battery, one automatic reversible booster and switchgear, one D.C. motor-generator and switchgear, for the Electricity and Tramways Committee. See "Official Notices" to-day.

Norway.—CHRISTIANIA.—The T.C. will shortly be in the market for the purchase of two three-phase turbo-generators of 5,000 and 6,000 KW., respectively, for the municipal power station. Particulars from the T.C.

Nuneaton.—January 21st. One water-tube boiler, with valves, fittings, &c., for the Corporation Electricity Department. See "Official Notices" to-day.

Plymouth.—January 23rd. Stores, for a year, for the Corporation Electricity and Street Lighting Departments. See "Official Notices" January 3rd.

Sheffield.—January 23rd. General stores for the City Tramways Department. See "Official Notices" January 3rd.

South Africa.—February 3rd. Cables, trolley wire, fittings, poles, converters, switchgear, &c., for the Germiston municipal trackless trolley scheme. Specification, &c., can be seen at the Board of Trade Commercial Intelligence Department in London.—*Board of Trade Journal.*

Spain.—January 18th. Municipal authorities of Riaza (province of Segovia). Concession for the electric lighting of the town during a period of ten years. Tenders invited.

January 18th. Municipal authorities of Suria (province of Barcelona). Concession for the electric lighting of the town during a period of ten years. Tenders invited.

Uruguay.—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

West Ham.—January 24th. Engine-room stores, chemicals and A.C. house service wattmeters, for the Council's electricity department. See "Official Notices" to-day.

CLOSED.

Batley.—The Corporation has accepted the tender of the Tudor Accumulator Co., Ltd., for the maintenance, for a period of 12 years, of the battery which it supplied to the electricity works.

Bristol.—The Electricity Committee has accepted the following tenders:—

British Westinghouse Co., Ltd.—Extra-high-tension and low-tension switchgear for Temple Back sub-station, at £908.

Bruce Peebles & Co., Ltd.—One three-phase to direct-current converter (No. 5) for Temple Back sub-station (of 1,000 KW.), £2,187.

Canada.—The Hart Accumulator Co., Ltd., have secured the contract for the supply of the storage battery, 1,190 ampere-hours capacity, required for Yellowgrass electricity works, Saskatchewan, Canada.

Chile.—TALCAHUANO.—Messrs. Gillespie & Beales, purchasing engineers for Messrs. Martin Bros., Valparaiso, have placed the following orders for this electric lighting scheme:—

Generators.—Laurence, Scott & Co.
Battery, &c.—Hart Accumulator Co.
Switchboard.—Ferranti, Ltd.
Cable.—W. T. Glover & Co.
Crane.—Holt & Willetts.
Steel poles.—Stewarts & Lloyds.
Lanterns and fittings.—Hadyn Harrison.
Asphalte flooring.—Limmer Asphalte Paving Co., Ltd.

Colchester.—The T.C. has accepted the tender of Messrs. H. G. Merry & Co. for 550 tons of Gelding and Shirebrook nutty slack coal for the electric light works, at 14s. 8d. and 14s. 10d. per ton respectively.

Eccles.—The Corporation has accepted the tender of the British Westinghouse Electric & Manufacturing Co., Ltd., for 12 months' supply of consumers' electricity meters.

Guildford.—The tender of Messrs. Carling, Gill and Carling, Ltd., of Guilford, has been accepted for the electric light installation at the new schools.

London.—STEPNEY.—The B.C. Electricity Committee received tenders for the supply of cable during the period ending December, 1915, from which the engineer has prepared the following statement :—

W. T. Henley's Telegraph Works Co., Ltd.	(accepted) £8,886
British Insulated and Helsby Cables, Ltd.	9,059
Callender's Cable and Construction Co., Ltd.	9,100
W. T. Glover & Co., Ltd.	9,176
Western Electric Co., Ltd.	9,198
Siemens Bros. Dynamo Works, Ltd.	9,225
St. Helens Cable Co., Ltd.	Unable to tender.

The specification includes a clause which provides for the adjustment of the price of cable according to the market prices of copper and lead at the time of ordering. The Council, consequently, does not guarantee to purchase any minimum quantity of cable, but the amounts of the tenders are calculated on the estimated quantities required.

For the supply of conduits, troughs and covers required during the same period, the engineer prepared the following statement on tenders received :—

	Stoneware conduits.	Fibre conduits.	Troughs and covers.
Albion Clay Co., Ltd. (recommended)	£2,481	—	—
Henley's Teleg. Works Co., Ltd. ..	2,684	£2,713	£1,269
Key Engineering Co., Ltd.	—	2,530	—
Siemens Bros. & Co., Ltd. .. .. (recommended)	2,754 (Less 2½ %.)	2,530	1,228 (Less 2½ %.)
B.I. and Helsby Cables, Ltd.	Unable to tender		
Callender's Cable, &c., Co., Ltd. ..		Do.	
W. T. Glover & Co., Ltd.		Do.	
I.-R., G.-P. and Teleg. Wks. Co., Ltd.		Do.	
Western Electric Co., Ltd.		Do.	

The specification provides either for the supply of stoneware conduits or fibre conduits, and, having regard to the difference in the amounts of the tenders for the two kinds of conduits, and to the suitability of the stoneware conduit, the last-mentioned is recommended, the Albion Clay Co., Ltd., to supply the stoneware conduits, and Messrs. Siemens Bros. & Co., Ltd., the troughs and covers.

HACKNEY.—The B.C. Electricity Committee has accepted the tender of Messrs. Geipel & Co. for flame arc carbons, at £2 15s. per 1,000 pairs ; also that of the Sloan Electrical Co., Ltd., for long open type arc carbons, at £3 8s. per 1,000 pairs, and for short open type carbons, at £2 17s. per 1,000 pairs. The other tenderers were the G.E. Co., Ltd., Crompton & Co., Ltd., Siemens Bros., Ltd. Messrs. Ship Carbons, Ltd., were unable to quote for open type, as their entire production up to the end of February, 1913, was already sold.

According to the *Railway Gazette*, the L. and N.W. Railway has placed a contract (valued at £500,000) with the firm of Walter Scott & Middleton, Ltd., for widenings and alterations, also 16 ft. 4 in. diameter cast-iron tube railways, in connection with its suburban electrification scheme. The same firm is also carrying out work on the extension of the Bakerloo tube from Paddington to Queen's Park, where it will link up with the L. and N.W. electric lines.

Runcorn.—The B, of G., which accepted the tender of Messrs. F. W. Smith & Co., of Manchester, for an engine for the electric light plant to be installed in the Children's Home, has given an order to the same firm for a duplicate engine.

Salford.—The following tenders have been accepted by the T.C. :—

A. E. Dean & Co.—Additions to switchboard, &c., at dispensary, £60.
General Electric Co., Ltd.—Electric fittings, £75.
E. M. Evans & Sons.—Wiring and fixing electric fittings, £26.
Clifton and Kersley Coal Co., Ltd.—500 tons No. 4 washed steam nuts, for the electricity works, at 12s. 11d. per ton.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, January 13th.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Tuesday, January 14th.—"B" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Thursday, January 16th.—"C" Company. Company training, 7 to 10 p.m.

Friday, January 17th.—"D" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Saturday, January 18th.—"D" Company. Week-end run at Fort Coalhouse. Dress:—Service dress, putties and greatcoat. No arms or equipment will be taken. Parade at Fenchurch Street Station, Midland, London and Tilbury section, at 3 p.m, for Low Street Station. Railway tickets will be issued by the senior N.-C.O. present.
Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

PROPOSED EXPENDITURE ON ELECTRICAL WORKS UNDER PRIVATE BILLS.

THE following estimates of proposed expenditure on electrical undertakings under powers sought in Private Bills this year appear in either the deposited estimates or the Bills :—

London County Council.—Tramways £344,500, subway £94,000, street widenings £216,820 ... ... £655,320

Hove Corporation (H. H. Scott, borough engineer).—Extension of electrical undertaking of the Corporation after the date of the transfer to the Corporation of the undertaking of the Hove Electric Lighting Co., Ltd., and the construction and provision of mains, works, fittings and apparatus, and additions to plant for and in connection with the electricity undertaking of the Corporation 30,000

Huddersfield Corporation (K. F. Campbell, engineer for tramways and street improvements, and R. H. Wilkinson, electrical engineer).—Permanent way for tramways £83,575, electrical equipment for tramways, £33,845 ; tramway rolling stock, £11,250 ; electrical equipment of trolley vehicles, £2,804 ; trolley vehicles, £1,500 ; motor-'buses, £7,500 ; street works, £2,530 143,004

London Electric Railway (H. H. Dalrymple Hay and A. R. Cooper, engineers).—No. 1 railway, 6 furlongs 1'40 chains, double, £220,784 ; No. 2, 1 furlong 2'25 chains, single, £33,682 ; No. 3, 1 furlong 2 chains, single, £23,299 ; No. 4, 1 furlong 4'50 chains, single, £45,566 ; No. 5, 1 furlong 5'3 chains, single, £59,354 ; deviation railway, No. 1, 1'65 chains, single, £5,496 ; deviation railway, No. 2, 1'75 chains, single, £5,751 ; No. 6 railway, 4 furlongs 4'90 chains, single, £238,635 ; No. 7 railway, 3 furlongs 5'35 chains, single, £32,664 665,231

Central London Railway (Mott & Hay, engineers).—No. 1 railway, 2 furlongs 1'1 chain, single, £32,363 ; No. 2, 1 furlong 9'16 chains, single, £175,545 ; No. 3, 1 furlong, single, £23,302 ; No 4, 2 miles 1'5 chains, double, £597,248 ; No. 5, 3 furlongs 3'9 chains, double, £88,614 759,072

Leeds Corporation (J. B. Hamilton, general manager of tramways).—Construction of tramways, £63 958 ; provision of tramcars, £6,000 ; provision of trolley vehicles, £22,500 ; provision of electrical equipment and construction of other works necessary for the tramways and trolley vehicles, £43,645 ; land for sub-station and depôt for tramways and trolley vehicles, £3,000 ; sub-station and depôt and plant and cables in connection therewith, £34,438 173,541

City and South London Railway (Basil Mott and D. Hay, engineers).—Enlargement of 7 miles 3 furlongs 6'8 chains of tunnels, £346,000 ; contingencies, 15 per cent., £51,900 ; easements, £992 398,892

Chesterfield Corporation Railless Traction (R. L. Acland, electrical engineer).—Buildings, car-sheds, depôts, £2,000; overhead equipment and the construction of other works necessary for the working and lighting of trolley vehicles, £33,780 ; provision of trolley vehicles, £6,400 : motor-omnibuses and expenses in connection with running thereof, £16,000 58,180

Derby Corporation (J. Ward, borough engineer).—Construction of tramways, £24,000 ; provision and erection of posts, standards, brackets, and other apparatus for the purpose of the tramways, £6,000 ; provision and equipment of motor-'buses, £5,000 ; street works, &c., £79,000 114,000

Dundee Corporation.—(J. Thompson, engineer)—Tramways 13,000

Halifax Corporation (J. Lord, W. M. Rogerson, and J. W. Galloway, engineers).—Permanent way of tramways and tram-road, £147,738 ; tramway rolling stock, £22,200 ; electrical equipment, £24,975 ; motor-'buses, £11,000 ; street works, £50,055 255,968

Nottingham Corporation (A. Brown, city engineer ; J. Aldworth, tramways manager ; and H. Talbot, electrical engineer)—Construction of tramways, £19,250 ; tramway rolling stock, £14,600 ; electrical equipment and other works, £9,950 ; provision of trolley vehicles, £15,500 ; electrical equipment and construction of works necessary for trolley vehicles, £8,950 ; provision of motor-omnibuses, £39,375 ; land and buildings for trolley vehicles and motor-'buses, £8,775 116,400

Mexborough and Swinton Tramways (F. E. Stanley, engineer)... 600

Metropolitan District Railway (A. R. Cooper, engineer). —Widening of Fulham extension 26,739

Metropolitan Railway (W. Wilcox, engineer).—Railways and lands... 552,165

Southport Corporation (A. S. Black, electrical engineer and tramways manager).—Trolley vehicles, £3,000 ; electrical equipment for trolley vehicles, £6,500 ; motor-'buses £2,000 13,500

Western Valleys (Mon.) Railless Electric Traction (J. W. Szlumper, engineer).—Roads, £300	£300
West Bromwich Corporation (A. D. Greatorex, engineer).—Provision of trolley vehicles, £20,000; provision of motor-'buses, £8,000; lands and street improvements, £15,000	43,000
Leicester Corporation (E. G. Mawbey, engineer).—Tramways, £69,627	69,627
Brighton Corporation.—Purchase of land and construction of sheds with underground cableways and cables, £9,000; overhead line equipment, shelters, &c., £5,300; trolley vhicles, £4,900	19,200
Colne Corporation.—Working capital of light railway to be acquired, £2,000; reconstruction and improvement of light railway, £10,000	12,000
East Ham Corporation.—Purchase of equipment of trailer cars	1,000

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Dublin Section).—Friday, January 10th. At 8 p.m. At the Royal College of Science, Dublin. Paper, "Notes on Self-Propelled Cars for Light Railway Work," by Mr. J. P. Tierney.

(Western Section).—Monday, January, 13th. At 4 p.m. At the South Wales Institute of Engineers, Cardiff. Discussion on paper on "Overhead Transmission Lines" to be resumed. Address on "Automatic Telephones," by Mr. W. Aitken.
At 6.30 p.m. At the Park Hotel, Cardiff. Dinner.

(Manchester Section).—Tuesday, January 14th. At 7.30 p.m. At the University, Manchester. Paper on "Starting and Speed Control on Induction Motors," by Mr. F. C. Aldous.

(Scottish Section).—Tuesday, January 14th. Meeting at 8 p.m. At 207, Bath Street, Glasgow.

(Yorkshire Section).—Wednesday, January 15th. At 7.15 p.m. At the University, Leeds. Lecture on "Comparative Notes on Independent Steam Condensing Plants," by Mr. W. A. Dexter.

(Students' Section).—Wednesday, January 15th. At 7.45 p.m. Paper on "The Conditions Influencing the Design and Minimum Manufacturing Cost of Induction Motors," by Mr. E. T. Driver.

Electro-Harmonic Society.—Friday, January 10th. At 8 p.m. At the Holborn Restaurant. Smoking Concert.

Institution of Post Office Engineers (Metropolitan Section).—Monday, January 13th. At 6 p.m. At the I.E.E. Paper on "The Electrophone Service," by Mr. J. H. Pattman.

Institution of Mechanical Engineers (Graduates' Association).—Monday, January 13th. At 8 p.m. Paper on "Electric Accumulators," by Mr. W. C. Paddock.

Institution of Mechanical Engineers. Friday, January 17th. At 8 p.m. Paper on "Indicators," by Mr. J. G. Stewart.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, January 18th. Meeting at 4.30 p.m. At the Royal Technical College, Glasgow.

NOTES.

Metallic Illusions.—Mr. T. Vaughan Hughes A.R.S.M., writes pointing out that users of metals and alloys in general do not sufficiently realise that many cases of corrosion of their copper pans and boilers, mysterious breakages of chains and railway accessories, and sudden failures of condenser tubes and copper pipes are due to two easily preventable causes described below.

In order to satisfy the demand for beauty of form, or the modern craving for cheapness, many ingenious mechanical devices have been evolved by manufacturers' works staffs, which put upon the metallic articles while being made uneven strains, or introduce in antiquated furnacing appliances deleterious compounds, which ultimately render the articles useless, and often enough dangerous to human life and property. An attempt is made to remove these strains by annealing in unevenly heated furnaces.

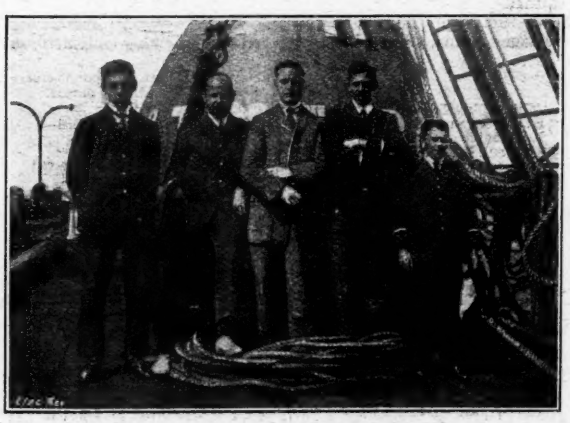
A few manufacturers, whose products are subject to constant physical tests, are quite alive to the situation. It must also be conceded that manufacturers of ferrous and non-ferrous metals and alloys spare no pains to free them while in the molten state from deleterious substances. They employ expensive deoxidisers—ingenious devices to prevent contact of the liquid metal with the air during the casting operations, all tending to produce soundness in the ingots or castings, *i.e.*, to free them from blow-holes and segregations.

No sooner is this desirable end attained, than the metal or alloy is introduced into furnaces wherein hot gases containing free oxygen, sulphur and other objectionable elements are allowed to impinge upon, or envelop, the metal. While hot they are brought out of the furnace into the air and mechanically treated in an atmosphere containing oxygen. This operation is often repeated several times. In cases of cold working the metal is, with few exceptions, annealed between processes in furnaces to which the air has access. After this heat treatment it is withdrawn and allowed to cool, sometimes in approximately closed receptacles—oftener in the air. Not only is the surface of the metal oxidised or tarnished, but during the whole time of heating, and partly in cooling, solution of oxygen and other gases takes place, with formation of compounds in intergranular spaces, or in the body of the metal or alloy, which form centres or areas of corrosion when in use. In the last year or two exact investigations and experience have proved beyond doubt that both the above defects in heat treatment are prolific causes of corrosion and other breakdowns.

Mr. Hughes therefore submits that the time has arrived for all engineers and users of metals and alloys to insist and specify that, at least, two causes of failure of metals and alloys under the control of the makers shall be removed, namely, (*a*) Uneven heating appliances; (*b*) Antiquated heat treatment in chemically and physically active atmospheres.

Incidentally, the public health will benefit, because all the appliances on the market capable of bringing about the above results are smokeless when in operation. The present unnecessary and wicked waste of one of our natural resources, viz., coal, will also be curtailed.

"Centralians" and Cable Laying at the Antipodes.—Graduates of the Central Technical College, South Kensington, now called the City and Guilds (Engineering) College, are, as is well known in the engineering world, at work "keen in their vocation" in all quarters of the globe. It is not, however, a common occurrence that five Associates of three different years find themselves together on a single job. This recently happened on the occasion of laying submarine telegraph cables between Sydney and Auckland (N.Z.), 1,200 miles, and Doubtless Bay (N.Z.) and Auckland, 140 miles. The photograph reproduced here



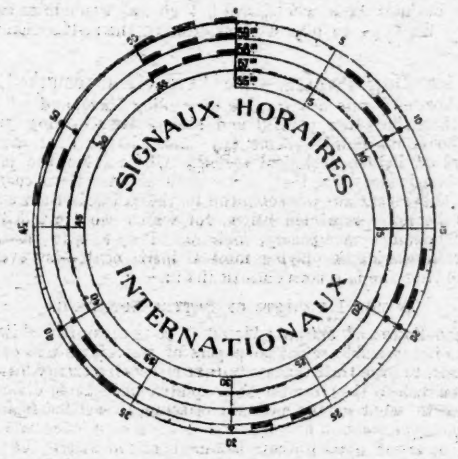
shows the group on board the cable steamship *Silvertown*, owned by the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., the contractors for the manufacture and laying of the cables. Starting from the left-hand side, the men are:—Bernard S. Lion (1909-12), Frank P. Swann (1906-9), Nelson J. Perryman (1908-10), Edgar A. Beavis (1909-12), and Thomas H. Solomon (1909-12). Mr. Perryman went out as representative of the consulting engineers, Messrs. Clark, Forde & Taylor, and the other four were employed by the contractors as assistant electricians on the *Silvertown*. The work of laying the cables was completed early in December, 1912, and the photograph reached the College as a Christmas card.

Electricity in Mines.—Part 2 of the Report of the Chief Inspector of Mines, just issued by the Home Office, is rather a belated document, as it only deals with 1911, but there is a good deal of interesting information in it, especially with regard to the use of electricity in mines. Mr. Nelson, the Electrical Inspector of Mines, who during the year made a number of underground and surface inspections of electric plant in mines, besides investigating accidents at mines due to electricity, reports that electricity was newly introduced into 46 mines in 1911, as against 40 in 1910. The districts were:—Scotland, 20; Newcastle, 4; Durham, 2; Liverpool and North Wales, 2; South Wales, 13; and Midland and Southern, 5. The electricity special rules in force during 1911 merely required that the introduction of electricity should be notified, but this has been remedied by the Coal Mines Act, and a complete classification of the different systems of distribution, together with a measure of the growth of the use of electricity in mines, will be made possible for the future. Such particulars as are now available show that the high-pressure alternating-current system was introduced into five mines, the medium-pressure alternating-current system into 11 mines, the medium-pressure direct-current system into 13 mines, and the low-pressure direct-current system into four mines. In the latter case the current was introduced in each instance for lighting purposes only. The number of electrically-driven coal-cutting machines in use at the end of 1911 was 998, an increase of 125 over those in use at the end of 1910. During the year 14 fatal accidents were reported and investigated, causing in all 15 deaths, but of these two, causing three deaths, strictly speaking, had no connection with the use of electricity in or about mines. In 1910 there were 21 fatal accidents. Of the 12 deaths in 1911, all but one were electric shock accidents, the remaining one being due to an ignition of fire-damp by electricity. Three underground fires were reported to have been due to electricity. It is also stated that the possibility of the application of wireless telegraphy to mines opens out an interesting field for speculation, and it is obvious that it might prove a valuable aid during rescue operations. We shall refer to the matter more fully in a later issue.

International Time Conference.—In connection with the proceedings of the recent conference on wireless time signals, *La Technique Moderne* quotes a note of M. G. Bigourdan communicated to the Academy of Sciences, giving the following list of stations which will probably be in a position by July 1st, 1913, to act as centres for the emission of time signals, at the hours named.

	Hours (Greenwich time).
Paris	0 midnight
San Fernando (Brazil)	2
Arlington (United States)	3
Manilla	4 (provisional)
Mogadiscio (Italian Somaliland) ...	4
Timbuktu	6
Paris	10
Norddeich-Wilhelmshaven	12 (noon)
San Fernando (Brazil)	16
Arlington (United States)	17
Massouah (Erythrea)	18
San Francisco	20
Norddeich-Wilhelmshaven	22

The signals will be sent out in accordance with the plan here illustrated, covering the four minutes immediately preceding the hour of the signal; from the end of the 57th minute warning signals are sent for 50 seconds, followed by the first time signal,



the close of which marks the beginning of the 59th minute. The time signals then follow every 10 seconds for two minutes, ending precisely at the hour; these signals consist of "dashes" lasting one second and dots lasting ⅕ second, with intervals of one second. The wave-length employed will be about 2,500 m.

Electricity Supply Rifle League.—The following are the results of the matches shot during December in connection with the above League:—Westminster (H. A. Pearman, 98), 572, *v.* Stepney (Jager, 99), 554; Westminster (Neville, 98), 572, *v.* Central (Brackley, 94), 550; Stepney (Barber, 99), 547, *v.* Shoreditch (Weekes, 99), 571; Ilford (Haeger, 96), 554, *v.* Central (Gaze, Cope, Wells, 96), 567.

FINAL POSITION OF CLUBS.

Club.	Shot.	Won.	Lost.	Drawn.	Points.	For.	Against.
Westminster ...	10	10	0	0	20	5,685	5,499
Central	10	7	3	0	14	5,552	5,520
Shoreditch ...	10	6	4	0	12	5,614	5,519
Stepney ...	10	3	6	1	7	5,470	5,552
Ilford	10	2	8	0	4	5,403	5,557
Hackney ...	10	1	8	1	3	5,426	5,503

Automatic Pipe Cleaner.—The latest development of the penny-in-the-slot machine is a device in which is incorporated a small electric motor, driving a self-adjusting revolving scraper, to clean the bowl of a tobacco pipe; a jet of compressed air cleans the stem. We understand that these machines are about to be placed about London.

R.A.C. Trial of an Electrical Delivery Van.—We are glad to learn that a trial of an electrical delivery van is this week being carried out under the supervision of the Royal Automobile Club. The vehicle, which has been entered by Mr. J. F. Monnot, of 41, Great Portland Street, W.C., is fitted with a battery of Edison accumulators. The trial, which started on Monday last, will extend for six days.

National Physical Laboratory.—The exhibit of the N.P.L. at the Ghent Exhibition this year will relate to the special researches which have been carried on at the Laboratory in connection with aviation. Remarkable and important results have been obtained with the elaborate equipment provided for this purpose, which will exert a considerable influence on the design and construction of aeroplanes, and the exhibit will be of great interest and novelty.

Accident.—A daily paper reports that at Sunderland last week a boy was badly burned about the neck, by a burning carbon falling from an electric arc lamp on to his celluloid collar.

Electro-Harmonic Society.—To-night at 8 p.m. there will be a smoking concert of this Society at the Holborn Restaurant (King's Hall), with Mr. David Smith in the chair. The preliminary programme is as follows:—Vocalists: Mr. Gwilym Richards, tenor; Mr. Norman Williams, baritone; Mr. Robert Maclachlan, bass. Flute and harp: Messrs. Arthur Hands and Lorenzi. Character impersonator: Mr. Ernest Cherry. Stories and imitations of actors: Mr. Lewis Benet. Entertainer at the piano: Mr. Harold Montague. Solo pianoforte and accompanist: Mr. Bernard Flanders, A.R.A.M.

Eviction.—The *Times* and other papers report that on New Year's day there was a *mêlée* at the headquarters of the Amalgamated Society of Engineers in Peckham Road, London, when, in consequence of the dispute arising out of the proceedings of the recent delegate meeting in Manchester, the executive council was forcibly evicted from the offices. The eviction was carried out by a number of members of the Union connected with branches in and about London, said to be acting on behalf of the trustees recently dismissed by the executive. Four persons sustained injuries.

Provisional Orders.—The Board of Trade (Harbour Department) has issued a printed list of applications for provisional orders that have been deposited with the Board for consideration during the 1913 Session. Names of promoters and agents are given.

How to Become an Electrical Engineer.—At the meeting of the Trim Board of Guardians, on Saturday, a letter was read from the Local Government Board relative to the proposal to allow a sum of £20 a year to the master for superintending the electric light, asking to be informed whether the master possessed the technical knowledge necessary for the performance of the work in question, and when he acquired it. Mr. Shannon: Tell them that he was with the man erecting the plant, and that the Board are satisfied that he possesses a sufficient knowledge of the working of the plant.

Board of Trade and Electric Lighting.—The *Journal of Gas Lighting* is greatly chagrined to discover that the B. of T. will have nothing to do with obsolete systems of lighting (such as gas) when it can obtain electric light. It appears that a local gas manager offered his assistance in rearranging the lighting in a new labour exchange in the North; to his surprise he was officially notified from Westminster that it was impossible to use gas as the Board had decided that "electric light should be installed wherever available throughout the country."

Davis Cup Football League.—The majority of the matches in this League, composed of large electrical firms in London, have now been played. The present standing of the teams is as follows:—

	P.	W.	L.	D.	Goals for.	Goals against.	Points.
G.E.C.	4	4	0	0	16	0	8
Ediswan	3	1	1	1	5	8	3
St. James'	4	1	2	1	10	9	3
Drake & Gorham ...	2	1	1	0	4	7	2
Elec. Installations ...	3	1	2	0	4	5	2
Glengall Works ...	2	0	2	0	1	11	0

Fatalities.—PRUDHOE-ON-TYNE.—An inquiry was held at Prudhoe-on-Tyne on December 31st, by Coroner Rutherford, into the circumstances of the death of Joseph Wormald, the driver of an electric motor. Mr. J. E. Forster said he was the contractor for a new coal drift at Hedley Park, near Prudhoe. He was in the blacksmiths' shop on the preceding morning, 30th ult., and Wormald was standing at his motor 5 yards away, with his hand on the lever. Witness turned his back to him for a minute, and when he turned round again deceased was lying on his back, partly on the platform on which he worked, and partly on the floor. Witness went to him and found him unconscious. Deceased had evidently touched something through which electric current was passing. Mr. John Graham, electrical engineer, said the current was supplied from Mickley Colliery, 2½ miles away, at an average pressure of 450 volts D.C. Wormald was working a small 10-H.P. motor (portable haulage). His duty was to put the clutch into the gears, and start his motor. Witness examined the motor after Wormald's death, and found nothing wrong. In his opinion, Wormald's right hand must have come into contact with the live part of the switch. He thought the man had touched the live part in inadvertence. Dr. Robert Blair Lockhart said there were no marks on Wormald's body. In his opinion death was due to an electric shock. The jury found that the deceased died from electric shock caused by coming into contact with electric machinery at which he was working, and recommended that some protective means should be at once adopted to prevent similar accidents.

NEWCASTLE-ON-TYNE.—An inquiry was held on the 3rd inst. into the circumstances of the death of William David Varley, a fitter, who died at the motor works of Armstrong, Whitworth and Co., Elswick, Newcastle-on-Tyne, on December 23rd, while using an electric drill. Evidence by a fellow-workman showed that Varley was working a portable electric drilling machine when suddenly he fell backwards on to the floor. Artificial respiration was tried, without effect. James McKinnell, foreman electrician, said he examined the machine and found it all right. He showed how a shock could be received from the machine. Dr. Snowdon said Varley's heart weighed 20 oz., whereas a normal one weighed

11 oz. Death was due to heart failure, brought about by some external cause (such as an electric shock), or by the condition of the heart itself. The heart had been in that condition for many years, and the man might have died at any time. The jury returned a verdict that death was due to heart failure, but how brought about there was not sufficient evidence to show.

LEEDS.—Elijah Jackson, aged 36 years, of St. James' Place, Holbeck, Leeds, an electrician employed by the British Thomson-Houston Co., Ltd., died in the Leeds Infirmary on Saturday from injuries received in an accident at the works, when both his legs were broken.

TUDHOE.—An inquest was held last week at Spennymoor (County Durham) on the body of Emmerson Lancaster (57), who was killed whilst working at the Weardale Steel, Coal and Coke Co.'s coke ovens, Tudhoe. William Birken, a fellow workman, said he saw deceased near a wire rope, connected with a winch. He heard Lancaster scream, and on going to his assistance, found him in a stooping position, and holding the winch rope. Deceased shouted, "Don't touch me, but go for someone else." William Robertson, in charge of the chemical works adjoining, said that the winch was used for taking down a large casting for a superheater. He could not tell how the live wire came in contact with the winch rope. William John Shand, electrician, said he went to the scene shortly after the accident, and found that the wire rope had been in contact with a live wire. He could not form any idea how the wire came in contact with the winch rope. The jury returned a verdict of "Accidental death," attributing no blame to anyone.

Educational Notes.—CITY AND GUILDS OF LONDON INSTITUTE.—At the Technical College, Finsbury, a special course of six advanced lectures on "Induction Motors" will be given by Mr. J. K. Catterson-Smith, M.I.E.E., on Monday evenings, commencing January 27th, at 8 o'clock.

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS.—The annual dinner and reunion of the Institution will be held at the Hotel Cecil, Strand, London, on Thursday, February 6th, 1913, under the presidency of Mr. W. Duddell, F.R.S., supported by the Council. Early application for tickets should be made; the charge is 10s. 6d. each.

INSTITUTION OF ELECTRICAL ENGINEERS (BIRMINGHAM SECTION).—A meeting was held on Wednesday, at the University, Edmund Street, Birmingham, to hear and discuss a paper by Prof. Miles Walker, entitled "The Design of Apparatus for improving the Power Factor of Alternating-Current Systems."

For Sale.—The Winchester Corporation has for disposal one 200-KW. and two 50-KW. Belliss-Parker generating sets. See our advertisement pages in this issue.

International Electrotechnical Commission.—The meetings of the Special Committees will be held at Zürich on the following days: Symbols, January 13th and 14th; Rating, January 15th, 16th and 17th; Prime Movers in Connection with Electrical Plant, January 18th and 19th. The Committees are constituted as follows:—

Country.	Special committee on		
	Symbols.	Rating.	Prime movers.
Austria ...	—	Prf. Pichelmayer	Dr. K. Kobes
Belgium ...	Prof. E. Gerard	Prof. E. Gerard	—
France ...	Prof. Paul Janet	M. P. Boucherot	M. Ad. Bochet
Germany ...	Geh. Dr. K. Strecker	Herr Leo Schüler	Direktor H. Tonnemacher
Great Britain	Dr. R. T. Glazebrook, C.B.	Dr. Gisbert Kapp	Mr. G. Stoney, M.Inst.C.E.
Holland ...	Prof. Dr. de Haas M. G. J. Van de Well	—	—
Italy ...	Prof. M. Ascoli	Prof. E. Morelli Sig. G. Semenza	Sig. G. Semenza
Norway ...	—	—	Mr. W. Fougnez
Spain ...	Sr. L. de la Pena	Sr. L. de la Pena	Sr. L. de la Pena
Sweden ...	—	Mr. J. L. la Cour	(to be appointed)
Switzerland	Prof. Dr. Wyssling	Herr Huber-Stockar	Dr. H. Zoelly
U.S.A. ...	Mr. C. O. Mailloux	Mr. C. O. Mailloux	Mr. H. G. Stott

With regard to the rating question, much of the time of the delegates will naturally be occupied in dealing with the numerous amendments to Report 17 of the I.E.C., issued by the Central Office in June, 1912, as the result of the work accomplished in Paris in May last, when, after much preliminary discussion, certain definite proposals were put forward.

The subject of international rating is undoubtedly of importance to the electrical industry of this country, with its growing foreign trade; the co-operation of the Manufacturers' Association, the B.E.A.M.A., has, therefore, been of considerable value to the Joint Committee (of the Engineering Standards Committee and the British Electrotechnical Committee), by which the Paris proposals, referred to above, have been fully discussed in detail. The representative of the makers (Mr. A. R. Everest) is to accompany Dr. Gisbert Kapp to Zürich. Although he is not going as a delegate, Mr. Everest's intimate knowledge of manufacturing details, as well as difficulties, will be of no small value to the delegate of the British Committee.

Petrol-Electric Railway Car for Wellington, N.Z.—Our Wellington, N.Z., correspondent states that the New Zealand Government Railways Department has placed an order with Messrs. Grapes & Riley, of Wellington, for a self-propelled car, of which the body will be built in New Zealand. The gearing is to be on the Thomas transmission system. The estimated weight, fully loaded, is 32 tons, and the car is to be capable of hauling a trailer weighing 25 tons loaded. The truck is to be built by the Leyland Motors, Ltd., and to have an engine developing 160 B.H.P. at 900 R.P.M., but capable of being worked up to 200 H.P., with two electrical machines, each rated at 50 H.P. at 500 R.P.M., for half an hour. The general design is similar to that of the car, which has been giving such good results in South Africa, and it is to maintain a speed, with trailer, of 25 miles per hour on the level, and 10 miles on a gradient of 1 in 40. It is understood that a further order is to be placed with the British Westinghouse Co. for a car on their system, and that tests will be made between them with a view to determining which type is the most suitable for the Dominion.

'Tricity House.—A complete and up-to-date electrical restaurant has been opened by Messrs. Modern Kitchens, Ltd., at 48, Oxford Street, W., and a demonstration of its capabilities was given on Tuesday last. The equipment consists of the well-known "Tricity" apparatus, with which the whole of the cooking is done. The promoters are to be congratulated upon their enterprise, which will undoubtedly prove highly beneficial to the electric cooking business as a whole, and to their own specialities in particular. We hope to give a description of the installation in an early issue

On Reading Papers.—We have often remarked that few authors of papers are capable of reading them, and we have urged that the often painful and always time-wasting process should be discontinued. Some day that will be done, and the members of British technical societies will receive the printed papers in advance, like their more fortunate American *confrères*. But in the meantime we commend to the perusal of our author-readers the letter reprinted below, for which we are indebted to our American contemporary, *Science*. People take lessons in singing, in dancing, in playing musical instruments—but everyone seems to think he is a born elocutionist!:—

IN THE INTERESTS OF BETTER SPEAKING.

To the Editor of *Science:* Would it be at all worth while, now that the innumerable scientific papers of the midwinter are about to be read, to urge their readers to take a few elementary lessons in elocution before they ascend their platforms? It is difficult to compute to what extent æsthetic pleasure, as well as facility of comprehension, would be added to if men of science understood better the art of putting their communications before the public. The main work of the professional elocutionist would be to show the prospective reader how to produce full, clear, rotund chest tones, instead of the thin, clouded, head tones which they too often adopt. If the dozen or so of precious hours that this would take is too much to demand, perhaps the following simple rules might be of some assistance; I am sorry that they are so very elementary, but in point of fact they are rules which are violated by fully one-half of those who read:—

1. Stand erect, with chest expanded, and not contracted.

2. Consult a physician, and see that the nasal bones do not obstruct the nasal passages.

3. If manuscript is to be read from, hold it in the hand (and hold it high). Manuscript which is stationary on a desk causes a rigidity of the body which should be avoided.

4. The length of the line of type-written manuscript must be short—not more than 7 in. This is very important. The long line of the ordinary typed manuscript is convenient for the typewriter, but it is fatal to the reader. The effort necesary to catch the right line as the eye returns to the left-hand margin of the paper consumes energy which should be devoted to securing that mysterious *rapport* that must be established between reader and hearer if the function is not to be a painful one. For the same reason the type must be good and black, and the lines far apart. Whatever contributes to the physical ease of the speaker conduces also to that free and undistracted state of mind which is indispensable to the securing of the desired *rapport*.

5. Better still—make a mental note of the *Art und Weise* of those men of science (half our number, perhaps), who, whether by instinct or by early training, know how to address an audience effectively. There is a subtle mental attitude about them, quite aside from physical details, which can, perhaps, be better caught by instinctive imitation than by conscious intention. May their tribe increase!

6. If, in addition, every individual reader would, in his own interest, see to it that there is enough oxygen in the audience-room to permit of ready comprehension on the part of his hearers, then, indeed, would the mid-winter scientific meeting become such a joy to the spirit as would brighten, in retrospect, many a coming month of solitary hard labour.

The essential matter of inspiring papers is always at hand; a little furbishing-up of method of presentation is all that is needed to make that matter far more effective, in the way of presentation, than it is, too often, at present. Of this the reader may be certain—if he insists upon beginning his paper with his voice thin, low and veiled, and directed downwards upon the floor instead of outwards towards the level of his hearers' ears, the spirits of his auditors, so far as they have any æsthetic quality at all, will also descend to their boots, and will remain there until another speaker gives them a chance of better nourishment.—X.Y.Z.

Quietness Preferred.—In the backblocks of New Zealand, where roads are bad and in wet weather at times almost impassable, telephonic communication on the party-line system is extensively used. Investigating a fault on a line with seven or eight subscribers recently, it was found that a lady had tired of the continual ringing in the evenings amongst her neighbours, and had adopted a method of her own to stop it. She took down the microtelephone and inserted a large cork in the transmitter mouthpiece.

Appointments Vacant.—Telegraph and telephone line superintendent, for the Government of Jamaica, Public Works Department (£250); laboratory assistant in the electrical engineering department of the South-Western Polytechnic. See our advertisement pages in this issue.

Parliamentary Notes.—TRINIDAD WHEEL TAX.—In Monday's Parliamentary Papers Mr. Pointer asked the Secretary of State for the Colonies whether his attention had been drawn to the Wheel Tax Ordinance recently brought before the Legislative Council of Trinidad; whether it had been passed by the Council; whether it had come within his notice that the provisions of the ordinance would not apply to the vehicles of the tramway company, who exercised their monopoly powers without any payment of any kind for the valuable monopoly held by them; and whether he was able to offer advice to the Trinidad Government, suggesting that the provisions of the ordinance should apply to the tramway company. Mr. Harcourt replied that the hon. member no doubt referred to the Port-of-Spain Carriage Licences Ordinance, 1912. That Ordinance had been passed by the Legislative Council, but had not yet been submitted to him for His Majesty's pleasure to be taken with regard to it.

AUCKLAND PARK COLLIERY EXPLOSION.—Sir H. Havelock Allen asked the Home Secretary whether he had yet received the report of the Inspector who investigated the explosion which took place at Auckland Park Colliery, County Durham, on October 29th last. In reply, Mr. M'Kenna said he had received a further report from the District Inspector, stating that the examination of the cable under the large fall showed conclusively that the cable was not the originating cause of the explosion. The origin of the explosion remained a mystery.

Electrical Imports and Exports in 1912.—The returns issued on Tuesday for the month of December, and for the complete year 1912, show the following figures:—

	Dec., 1912.	Dec., 1911.	Complete year. 1912.	1911.
IMPORTS.	£	£	£	£
Electrical goods and apparatus (other than machinery and telegraph and telephone wire)	137,464	138,581	1,457,646	1,435,492
Machinery	614,619	453,718	6,820,744	5,768,062
EXPORTS.				
Electrical goods and apparatus (as above)	320,119	217,219	4,369,877	2,819,374
Machinery	2,743,334	2,650,908	33,161,772	30,960,678

Copper.—A rather more cheerful tone in respect of European politics, and the prospect of better economical conditions at home, had their influence at the end of December on this as on other markets. The European visible supply (including stocks in Rotterdam and Hamburg) is shown by Messrs. Merton's statistical circular to have decreased during December from 43,281 tons to 43,241, a difference of 40 tons only. Withdrawals from English ports during the month have, apparently, been small, and covered by incomings, the quantity standing to home supplies being considerably higher than that for the end of November. Rotterdam has brought up its stocks (which were low) to 1,000 tons, while Hamburg registers 1,882 tons, a decrease of 333 tons during the month. In detailed supplies European arrivals from America are on the average, the quantity from Spain and Portugal to England and France is rather low, but the amount is compensated by increase in supplies from other countries. Chile shipments are well up, and Australian high (4,400, against an average of 3,780). Deliveries are brisk at 42,817 tons. American stocks (American Copper Producers' Association figures) increased during November 4,205 tons. The world's supply for the same date (November 30th, 1912) was 81,747 tons, an increase over the return for October 31st of 1,145 tons. The large withdrawals from stock last year in the United States were during January, according to figures.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—We are pleased to learn that MR. W. J. U. SOWTER has now sufficiently recovered from the effects of his serious accident of July last to enable him to resume charge of the Bray U.D.C. electricity undertaking. All communications should, therefore, now be addressed to him. We understand that MR. MCDONNELL, assistant engineer, has now left the service of the Council, and MR. V. DEMPSEY, of the Galway Electric Supply Co., has been appointed to succeed him, at a commencing salary of £104 per annum.

MR. DUNDAS FOX, manager of the Penrith Electric Supply Co., has resigned his connection with the company, and will shortly proceed to Calgary, Alberta, Canada, accompanied by MR. J. W. BLEASDALE, his assistant engineer at Penrith, where they will commence business as consulting engineers. The directors of the company, at a recent meeting in Manchester, accepted Mr. Fox's resignation with regret. Mr. Fox is to be succeeded at Penrith by MR. SPEIGHT, of St. Anne's, the company's consulting engineer.

The Burnley T.C. has increased the salary of MR. JAMES E. STARKIE, electrical engineer, from £400 to £500 per annum, as from January 1st.

The Electricity Committee of the Manchester Corporation has recommended to the City Council, that an agreement with MR. H. LAMB be prepared, appointing him resident engineer at the Stuart Street generating station, at a commencing salary of £350.

The Nelson (Lancs.) T.C. last week decided to increase the salary of MR. G. F. NAYLER, chief assistant electrical engineer, from £140 to £156 per annum.

Tramway Officials.—The employés of the Southport Tramways Co., Ltd., have presented a framed photograph of themselves to the general manager, MR. J. LLOYD, as a token of esteem.

General.—MR. H. R. KEMPE, M.Inst.C.E., M.I.Mech.E., M.I.E.E., and late Electrician to the Post Office, who has commenced work as a consulting engineer, notifies that his temporary address is 4, Ludgate Hill, London, E.C.

MR. C. D. FALCKE, who recently resigned the position of resident engineer to the Stratford-on-Avon Electric Supply Co., Ltd., has opened an office as consulting electrical and mechanical engineer at 410, Mansion House Chambers, Queen Victoria Street, London, E.C. Mr. Falcke went to Stratford-on-Avon six years ago to lay down the electricity works, and he subsequently acted as resident engineer. On his resigning that position, the directors appointed him to be their consulting engineer. We understand that he is now occupied with an interesting patent.

MR. H. W. POWER, engineering publicity expert, has removed from 180, Eswyn Road, London, S.W., to 31, Queen Victoria Street, E.C., where his telephone number is "City 8590."

MR. S. L. LORD, of the staff of Messrs. Crompton & Co., electrical engineers, of Chelmsford, who has been married to Miss K. M. Gaffney, daughter of Mr. J. N. Gaffney, of Broadstairs, has been presented by his colleagues at the Arc Works with a barometer.

At St. Cuthbert's Church, Darlington, on January 2nd, the marriage took place of MR. RUPERT STANLEY ALLEN, fifth son of Mr. W. H. Allen, J.P., D.L., of Bromham House, Beds., and of Messrs. W. H. Allen, Sons & Co., Ltd., electrical engineers, Queen's Engineering Works, Bedford, and Miss Gladys Marion Hill, elder daughter of Dr. Eustace Hill, of Birchfield, Darlington. The presents included a large silver salver from the staff of the Queen's Engineering Works.

MR. F. J. TEAGO, B.Sc., lecturer in electrical machinery and assistant lecturer and demonstrator in electrical engineering at Liverpool University, was married at Newcastle on January 2nd to Miss Annie Middlemiss, of Morpeth.

MR. WILLIAM WHITTLE, the chief accountant of the Metropolitan District Railway, has just retired, after 42 years in the service of the railway. The directors and officers presented him with a service of silver plate, and the staff, together with friends, gave an illuminated address and a gold watch. A farewell dinner was held at the Café Royal, with Lord George Hamilton, chairman of the company, presiding.

MR. HERBERT J. G. WEBB has been appointed manager of the apparatus department with the Electrical Co., his position as representative engineer in Yorkshire and the North of England for the same firm being taken by MR. HERBERT FOSTER, late with the York Corporation.

Messrs. Jaeger Bros., of 18, Christopher Street, London, E.C., announce that MR. H. STEINBACH has resigned the position of London manager to the firm, and MR. ERNEST JAEGER is taking up that appointment.

The COMTE DE BAILLEHACHE has been appointed director of our Paris contemporary, *La Lumière Electrique*, dating from January 1st.

MR. LEE MURRAY has been appointed to the seat on the board of directors of Messrs. Bruce Peebles & Co., Ltd., recently vacated by Mr. Charles H. McEuen. MR. S. E. BASTOW and MR. J. H. BUNTING have been appointed joint managers in the place of Mr. Murray, who has retired from the position of general manager of the company.

MR. C. H. WRIGHT is giving up his position with Messrs. Crompton & Co., Ltd., in order to take up an engagement with the National Steam Car Co., Ltd.

MR. W. C. MOUNTAIN has opened an office at 131, West Regent Street, Glasgow, in connection with his consulting engineering practice, and MR. J. E. MACEWAN will act there as his resident engineer in Scotland.

Obituary.—MR. SYDNEY WOODFIELD.—We learn with the deepest regret of the death of Mr. Sydney Woodfield, A.M.I.E.E., which occurred on December 3rd. Mr. Woodfield was a contributor to our pages whose services were most highly appreciated by us, and we greatly deplore his untimely death, which occurred under peculiarly sad circumstances. Our readers will remember that, eight months ago, he was appointed chief engineer to the Lacroze Co.'s electric traction undertakings in Buenos Ayres. He had prepared a home there in readiness for the arrival of Mrs. Woodfield, but just before her sailing day he cabled to England that he was seriously ill and had booked his return passage. He arrived in this country on November 24th, and he lived only until December 3rd.

The deceased gentleman was at different periods of his career connected with Messrs. J. G. White & Co., Ltd., the British Thomson-Houston Co., Ltd., the Glasgow Corporation Tramways Department, Leeds Corporation Tramways Department, and several of the technical institutions. We tender our sincere sympathy to his relatives.

NEW COMPANIES REGISTERED.

Eckstein, Heap & Co., Ltd. (126,262).—This company was registered on January 1st, with a capital of £50,000 in £1 shares, to take over the business of an electrical engineer and manufacturer of electrical apparatus, carried on by A. Eckstein, at Caroline Street, Broughton Lane, Salford, and at 5, Chapel Walks, Manchester, as Eckstein, Heap & Co. The subscribers (with one share each) are:—A. Eckstein, Brantwood, Oak Drive, Fallowfield, Manchester, electrical engineer; J. Hamer, Low Croft, Bowlacre Lane, Gee Cross, Cheshire, chartered accountant; P. B. Hall, Nesfield, Marple Grove, Prestwich, near Manchester, manager; D. B. Mellis, 4, Burlington Road, Altrincham, Cheshire, manager. Private company. The number of directors is not to be less than three or more than seven; the first are A. Eckstein (chairman and governing director), J. Hamer, P. B. Hall, and D. P. Mellis; qualification of J. Hamer, £3,000 shares; of other directors, £1,000 shares; remuneration (except managing director) as fixed by the company. Solicitor, P. H. Jordan, 1, Princess Street, Manchester. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Javal Patents, Ltd. (126,273).—This company was registered on January 1st, with a capital of £2,000 in 1s. shares, to carry on the business of manufacturers of and dealers in hydraulic, electric and steam machinery and appliances, engineers, founders, &c., and to adopt an agreement with E. Cremieu-Javal. The subscribers (with one share each) are:—F. Samuelson, 71a, Queen Victoria Street, E.C., solicitor; R. C. E. Poulter, Midland Bank Chambers, Queen Victoria Street, E.C., solicitor. Private company. The first directors are not named; qualification, £10. Registered office, 44, Basinghall Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Harry W. Cox & Co., Ltd.—Particulars of £1,000 debentures, created October 10th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's property, present and future. No trustees.

United Sherardising Co., Ltd.—Issues on December 12th, 17th and 20th, 1912, of £100, £400 and £200 debentures, parts of a series of which particulars have already been filed.

Salford Electrical Instruments, Ltd. (112,599).—Capital, £20,000 in £1 shares (10,000 preference); return dated May 16th (filed October 25th, 1912); 10,000 preference shares taken up; £10,000 paid. Mortgages and charges: Nil.

Forster & Sons, Ltd.—Particulars of £20,000 second debentures, created December 14th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Sheppey Water and Lighting Co., Ltd.—Charge on land and hereditaments at Minster-on-Sea, Sheppey, dated December 19th, 1912, to secure all moneys due or to become due from the company to London County and Westminster Bank, Ltd., 21, Lombard Street, E.C., stamped to cover £1,500.

Rawlings Bros., Ltd. (67,908).—Capital, £100,000 in £1 shares (30,000 preference and 70,000 ordinary). Return dated October 22nd, 1912, 20,685 preference and 38,169 ordinary shares taken up, £58,854 paid. Mortgages and charges: £6,812.

CITY NOTES.

Llandudno and Colwyn Bay Electric Railway, Ltd.

THE seventh ordinary general meeting of the above company was held on January 2nd, at the offices, Basildon House, Moorgate Street, E.C., Mr. A. W. Tait presiding.

The CHAIRMAN, in moving the adoption of the report, said the profit for the year was £6,023, as compared with £5,784 for the preceding year, an increase of £239. That increase was on the top of an increase of £2,172 for 1911, as compared with 1910. The traffic receipts amounted to £16,199, as compared with £15,359 last year, an increase of £840, or over 5 per cent. That increase would have been greater but for the disappointing weather during the summer, particularly during the month of August. The traffic during the winter months showed a steady improvement, which was due to the increase in the resident population along the route and to the improvement in the time and running of the service, and because of the increased facilities they were able to give owing to the double tracking of a considerable portion of the line. Turning to the debit side of the profit and loss account, it would be observed that the power expenses were £2,271, as against £2,530 last year—a saving of £259, or approximately 10 per cent. That was particularly satisfactory when he mentioned that that economy was effected in spite of an increase in the number of car-miles run of 8,899. The saving in units was 62,272, or approximately 13 per cent. The saving was really more than it appeared, because, owing to the sliding scale in their power-supply agreement, the less electricity they took, the higher they had to pay for it. The economies which they had effected during the last two years had been very great, and he thought they had now reached their maximum in that respect. The reductions which had been effected in the past two years amply justified the expenditure on double tracking, and credit was also due to the manager for the better inspection and lubrication of the motors and the general conduct of the service. There were small increases in the amounts charged for traffic expenses and interest, and there were small decreases in the amounts of general expenses and depreciation of equipment. The only other item calling for comment was that of repairs and maintenance. The amount this year was £1,481, as compared with £783 last year. Of that sum, approximately £657 represented expenditure upon permanent way, and approximately £656 upon cars, both of which items were in excess of the amounts charged under these heads last year. Part of that might be regarded as expenditure of a special nature. The large expenditure on the permanent way was due to some heavy repair work on the track in Colwyn Bay, where it had subsided owing to the track being laid over a green sewer trench. He was afraid that they could not expect to have any reduction of expenditure under that head for some time owing to the exceptional local conditions, and the wet summer and excessively wet autumn of last year had, of course, tended to make those conditions worse as regards the year under review. Wherever possible efforts were being made to render the condition of the track more satisfactory, and they would see that when the doubling work over Bodafon Fields was carried out a certain amount of regrading and reconstruction work was done at the same time, which had greatly improved that part of the line. They had also completed arrangements to double track the line at the top of Penrhyn Hill and from the end of Mostyn Avenue to a point beyond the North-Eastern Hotel in Llandudno. When that work was completed, the double track would extend for, approximately, four miles, which would enable them to cope more expeditiously and economically with the traffic, especially in the summer. Included under the cost of repairs, too, was the cost of repainting practically the whole of the cars and the complete overhauling of their equipments so that, at the end of the year, they were in excellent condition, and he thought they might expect to see some reduction in that item next year, because such an extensive overhaul should not be necessary. It would be observed that the company had expended during the year about £6,700 on additions of a capital nature, which he had already explained. The variations in the other assets were self-explanatory. With regard to the liabilities they had issued £3,175 additional debenture stock, and they owed to sundry creditors and on bills payable, approximately, £4,800 more. It would be necessary in order to pay the dividend which the directors recommended, and for other purposes, to issue a further amount of debenture stock. The order for the extension to Old Colwyn had now been confirmed by the Board of Trade, and arrangements with the Colwyn Bay Council as regards road widenings, were in progress. The terms upon which the company were willing to proceed with that extension had been clearly indicated to the Council, and he hoped that those would be accepted by them, as otherwise the construction of that extension must be held over. The balance available for distribution after adding another £1,000 to depreciation reserve account—making a total of £4,000 to date—and writing off £1,000 from discount and expenses of issue of debenture stock, amounted to £4,737, which included £714 brought in from the previous year. That sum the directors proposed should be applied in the following manner:—In payment on January 31st of a dividend at the rate of 3½ per cent. per annum (less income-tax), which would absorb £3,479, leaving £1,258 to be carried forward. He should, perhaps, point out that the sinking fund for the redemption of the debenture stock came into operation on the 1st inst., and in future the amount required for that purpose each year would appear as a debit to profit and loss account, and would take the place of the previous debits on account of depreciation reserve, because to all intents and purposes it was in substitution of that charge. He thought that the shareholders would agree that, particularly in the view of the unsettled weather, the net result for this year might be considered satisfactory, and he thought their thanks were due to Mr. Balfour and his firm, and to the manager at Llandudno for the careful supervision which had been exercised. There was one further point which he would like to mention before putting the resolution, and that was "Sunday running." He was glad to tell them that several local residents and visitors to North Wales had, during the past year, approached the company with regard to the matter, and there had also been some correspondence in the local Press. As he pointed out at the last general meeting, the restriction under which the company at present laboured did not affect the local residents, and it was for them to see that the great need for that service, which was evidently desired by many local people and by the large majority of the visitors to Colwyn Bay and Llandudno, was clearly impressed upon the local Councils.

MR. A. BALFOUR seconded the motion, and the report was adopted.

The A.E.G. Annual Meeting.

THE recent annual meeting of the A.E.G., as previously announced, sanctioned the proposed increase of £1,250,000 in the share capital to £7,750,000. Dr. Walter Rathenau, who presided, stated that the augmentation was materially influenced by the great pressure of new orders which could only be carried out with extreme difficulty, and it was therefore necessary to extend the workshops. In reply to questions, it was mentioned that the company did not hold a considerable portion of the shares in the Berlin Electricity Works, but the company's interest in the undertaking was exceptionally great. The real problems before the undertaking applied to the future;

it was no longer merely a lighting enterprise, but was already one for the supply of power on a larger scale, and it was submitted that the future programme would be one for the electrical incorporation of the suburbs and the province of Brandenburg, within the scope of the electricity works. The war in the Balkans had affected the A.E.G. comparatively to a much less extent than other undertakings, as the Balkans were not really an electrical hinterland for the company. The Constantinople express railway, for which a concession was expected, remained an important project, and would presumably be realised when quiet and order had been re-established. The company's business had also been but little affected by the Presidential election in the United States. The chief business was with South America, which was in favourable course of development, and had already yielded large orders. Concerning the transactions with the Victoria Falls and Transvaal Power Co., the speaker stated that the debentures taken over by the company were successfully disposed of some time ago. The sale prices for manufactures had not become worse, but rather slightly better. It was added that since the completion of the annual report, the position of orders and turnover had increased from £19,550,000 to £22,850,000, as compared with £18,100,000 at the end of September, 1911.

Continental Electrical Companies.

The Fabrik Isolierter Drähte (Insulated Wire Works, late C. G. Vogel), of Berlin, have allocated £6,500 to depreciation in 1911-12, as contrasted with £5,300 in 1910-11. It is intended to distribute 13 per cent. on the share capital, this comparing with 11 per cent. in the previous year.

The Siemens Elektrische Betriebe A.G., which manages a number of electricity works, earned considerably larger gross profits in 1911-12 than in the previous year. As net profits the accounts indicate the sum of £37,700, as against £27,700 in 1910-11. It is proposed to pay a dividend of 6½ per cent. on the old share capital, as in the preceding year, whilst the new capital of £250,000 will participate to the extent of 3½ per cent. for the year.

The Deutsche Gasglühlicht A.G., of Berlin, which manufactures wire lamps as well as incandescent gas lighting appliances, states that the Osram lamp department was extended during 1911-12, and the turnover increased. The foreign Osram lamp companies in London and Paris also obtained favourable results, although the profits were not included, as the balance-sheets had not yet been closed. The net profits of the Berlin company were £441,000, as contrasted with £278,000 in 1910-11, and the dividend on the ordinary shares is at the rate of 25 per cent.

The A.G. für Elektrizitäts Anlagen (Electrical Investment Co.), of Berlin, which owns various central stations, as well as being financially interested in others, reports gross profits of £61,000 in 1911-12, as compared with £36,000 in the previous year. Including the balance forward, the net profits are returned at £32,000, as against £32,000 in 1910-11, and a dividend of 8 per cent. has been declared on share capital of £350,000, being at the same rate as in the preceding year. During the year the extension of the company's scope of activity necessitated an increase of £150,000 in the share capital, whilst at the same time a 4½ per cent. loan of £300,000 was also raised for the same purpose.

The Elektrische Licht und Kraft-Anlagen A.G. (Light and Power Investment Co.), of Berlin, has just declared a dividend at the rate of 7½ per cent. for 1911-12 on the ordinary share capital of £1,500,000, as contrasted with 7 per cent. in the preceding year. According to the directors' report presented at the recent general meeting, most of the undertakings in which the company is interested made further progress during the year, and a share was also taken in various new enterprises having a promising future. The gross profits reached £208,000, as against £197,000 in 1910-11. After defraying general expenses, taxes and interest charges on the loan of £1,181,000, the accounts show net profits and balance forward of £136,000, as contrasted with £124,000 in 1910-11. The payment of the dividend absorbs £112,500, the reserve fund receives £12,900, and the sum of £8,000 has been carried forward. Among the list of advances made to electrical companies appear the names of two English undertakings.

The Telephonfabrik A.G. vorm. G. Berliner, of Hanover, reports that the turnover in 1911-12 experienced an increase. The Buda-Pesth Co., whose share capital is held by the Hanover Co., was satisfactorily employed during the year, Government orders also showing an advance over the previous year. A dividend of 10 per cent. was proposed by the Buda-Pesth Co., as compared with 9 per cent. in 1910-11, and that company's factory was in full operation. The branches of the Hanover Co. were well employed, and participation in foreign transactions again yielded satisfactory profits. The gross profits from sales and investments amounted to £70,000, as contrasted with £64,000 in 1910-11. After meeting general expenses and allocating £12,000 to depreciation, as against £8,800, the accounts indicate net profits and a balance forward of £24,700, as compared with £23,600 in 1910-11. It is intended to pay a dividend of 8 per cent., being at the same rate as in the previous year. The share capital is to be raised by £50,000 to £250,000.

SIEMENS & HALSKE.

[THE inter-relationship of the Siemens & Schuckert Companies explains the mutual references and information contained in the annual reports of the undertakings forming this group.]

The report of Siemens & Halske, A.G., for the year ended with July 31st, 1912, states that a considerable extension of the undertakings of the company and its group took place, and the number of officials and workmen employed by the company and the Siemens-Schuckert Works increased from 66,000 in 1910-11, to 77,000 in 1911-12. The growth was comparatively the greatest in connection with the German and Russian works, and the expenditure on plant correspondingly advanced. This development in association with the comprehensive technical progress rendered necessary a very fully connected and expensive organisation, whilst competition between the individual firms was very keen. An improvement in this respect was hoped for from the effect of the Verband Deutscher Elektrotechniker, which had already been successful in many directions. The report repudiates the idea of the establishment of any kind of monopolistic structure. As to the question of profits on financial transactions, it is stated that these play no noteworthy part in the company's scope. The latter had, of course, financially participated in individual undertakings or created such enterprises, but as a rule they related to new departments which required to be opened up. The volume of orders thereby resulting to the company and also from some companies closely associated with it, only formed a comparatively small portion of the total turnover of the group. A considerable increase in the orders was obtained for all the departments at the Werner Works, and an extension of the works had become necessary. Among the orders were those for automatic and semi-automatic telephone exchanges for Dresden, Leipsig and Rome, as well as an extension for Munich; and the Imperial telegraph authorities ordered a 50-twin telephone cable on the Pupin system for laying between Berlin and Magdeburg, which was proposed to be extended later on through the industrial district to the Rhine. Two of the State cable lines had been equipped with the company's new system of high-speed telegraphy, and it was expected to be further introduced. The Wireless Telegraphy Co. (Ges. fur Drahtlose Telegraphie) had made further progress, and had formed, in conjunction with the German-Netherlands Telegraph Co., the German South Sea Wireless Telegraph Co., which was to connect the German Colonies in the South Sea with the world's cable system. Concerning the manufacture of incandescent lamps, the report states that the glow lamp factory was abundantly provided with orders, and the new wolfram lamp had been well introduced, whilst the tantalum lamp maintained its special value. The department for railway safety appliances experienced an increased turnover in signalling installations and accessory apparatus, and, among others, the St. Petersburg branch obtained considerable orders from the Russian Government for the Siberian Railway. The first section of the elevated railway in Hamburg was set in operation on February 15th, 1912, and the whole of the circle railway, which is 10·5 miles long, was inaugurated on June 29th, 1912, whilst the completion of the branch lines was being continued. The accounts show the following results for the two years:—

	1911-12.	1910-11.
Share capital	£3,150,000	£3,150,000
Loan capital	2,265,000	1,287,000
Gross profits	722,000	691,000
General expenses	75,000	53,000
Interest on loans	60,000	51,000
Depreciation	20,000	22,000
Net profits and balance forward	620,000	616,000
Dividends	378,000	378,000
,, per cent.	12	12
Carried forward...	63,000	54,000

It will be seen that the loan capital has largely increased, the company having made an issue of £1,000,000 in 4½ per cent. bonds in May for the purpose of making an advance to the Siemens-Schuckert works. The sum of £100,000 has been placed to the special reserve fund, as against £110,000 in 1910-11, and £17,500 to the provident fund, as in the previous year, whilst the bonuses to officials and workmen has been raised from £40,000 in 1910-11 to £45,000 last year.

SIEMENS-SCHUCKERT WERKE.

THE directors state in their report for 1911-12 that the programme of extensions of works mentioned a year ago had been carried out, and the extensions in the meantime had been brought into operation, unusually large expenditure having been incurred on erection and equipment with machinery and the cost of removal. Nevertheless the arrival of orders was largely in advance of the completion of the new works, and extraordinary endeavours were therefore necessary in order to comply with the conditions of delivery. Difficulty was experienced in this respect owing to the circumstance that it was frequently impossible to obtain the requisite raw materials by the proper time. It was therefore all the more noteworthy that the German and ex-German works delivered 134,539 machines, motors and transformers, of a total of 3,737,674 H.P. The rising line of activity, which had only suffered one interruption since the formation of the company, took the same course in the past year, and this explained why the provision of additional funds in rapid succession had to receive attention. During the year a loan of £1,000,000 was obtained from the two proprietary companies, and the amount received from the latter in ordinary capital and loans was now £7,000,000. The proceeds of a new 4½ per cent. loan of £1,500,000, which was issued in the current year, were intended to further strengthen the working capital. The employment provided for the company by the development of overland central stations was very considerable as a result of the energetic enterprise which was manifested by all interested in that department. The works were well occupied on deliveries for tramways, light railways, colliery and works' railways, the elevated and under-

ground railways in Berlin and Hamburg and the various State railways proposed to be converted to electric traction. The following items are extracted from the accounts for the past two years :—

	1911-12.	1910-11.
Ordinary capital	£4,500,000	£4,500,000
Terminable loan	2,432,000	2,458,000
Non-terminable loan	2,500,000	1,500,000
Gross profits	1,048,000	913,000
General expenses	88,000	95,000
Depreciation	60,000	50,000
Net profits and balance forward ...	673,000	671,000
Reserve fund	125,000	125,000
Dividend	450,000	450,000
,, per cent.	10	10
Carried forward	15,000	14,000

It will be observed that the total of ordinary and loan capital amounts to £9,432,000, and to this has since been added a new loan of £1,500,000, making an aggregate of £10,932,000. The bonus granted to officials and workmen in 1911-12 were £65,000, being the same amount as in the previous year, whilst the provident fund received an addition of £17,500 as in 1910-11. The report mentions the financial interest of £425,000 taken in the Bergmann Electricity Works Co., and states that this event is not to be considered as a step in the direction of a proposed future amalgamation.

ELEKTRIZITATS GESELLSCHAFT VORM. SCHUCKERT & Co.

The report for 1911-12, after referring to the financial requirements of the Siemens-Schuckert Works in respect of a further loan of £1,000,000, states that the company's share of £500,000 of that sum was provided by an increase in the share capital of £500,000 to £3,500,000, the premium of £155,000 realised on the issue having been placed to the reserve fund. The Austrian Siemens-Schuckert Works, of Vienna, were well employed in 1911-12, and again made a distribution of 6 per cent., although on increased share capital, whilst the Russian Schuckert Co., which was compelled to extend its plant in order to cope with the growth in orders, raised its rate from 4 per cent. in 1910 to 5 per cent. last year, and had since resolved to make a capital issue of £100,000 to £300,000. The report proceeds to deal in detail with other undertakings in which the company is interested in different countries. The accounts indicate the following results for the two years :—

	1911-12.	1910-11.
Share capital	£3,500,000	£3,000,000
Loan capital	1,785,000	1,855,000
Gross profits	428,000	362,000
General expenses	20,000	15,000
Interest on loans...	79,000	82,000
Depreciation	783	100
Net profits and balance forward ...	352,000	293,000
Dividend	260,000	206,000
,, per cent.	8	7½
Carried forward	62,000	62,000

The sum of £15,000 has been allocated to the special reserve fund as in the previous year, and this fund now stands at £45,000, whilst the ordinary reserve fund has been raised to £485,000 by the addition of the premium realised on the new issue of shares. The central stations under the company's control represent £75,000, and other investments £1,890,000, but it has not been deemed necessary to make any provision for depreciation of the latter during the past three years.

Mexico Tramways Co., Ltd.—The directors have declared a dividend of 1¾ per cent.

British Coalite Co., Ltd.—The directors' report, as quoted in the *Financier*, states that the loss entailed on the operations for the 12 months to September 30th amounts to £11,192, in comparison with £26,265 for the previous year. The greater portion of this loss is due to contracts which matured during the year, and which could not previously be cancelled.

STOCKS AND SHARES.

Tuesday Evening.

THE Stock Exchange markets were not greatly upset by the various postponements of the Peace Conference, although the ultimatum published last Saturday morning had the effect of disturbing prices for a time. The view is now taken, however, that intervention by the Great Powers is practically assured, and on this theory prices in most of the investment—as well as the speculative—departments have quietly improved.

The feature in the Home Railway market is renewed strength in Metropolitans and Districts. The quotations of both went up with a run on the reassembling of the markets after their New Year holiday, and the only reasons which dealers could find to explain the sudden jump was the old one of syndicate buying. This, no doubt, had something to do with it in the case of Districts, while in regard to Metropolitans the market for some time past has been so restricted that a little extra demand or supply has sufficed to move the price sharply. Central Londons and City & South Londons are good, and there has been some improvement in East London Ordinary, attention being redirected to this stock on a steady rise in the price of Great Easterns. With the dividend announcements and distributions just at hand, and with the prospect of money becoming a little easier, it is not surprising that proprietors of Home Railway stocks should be chary about selling at present, and this naturally makes for strength in the market.

The Electricity Supply section waits upon fresh developments in connection with the linking-up negotiations. These, it is said, are by no means broken off ; and in anticipation of some news or other becoming available before long, prices of the principal Electric Lighting shares are holding with noticeable steadiness, having regard to the probably increased costs which the next balance-sheets are likely to show in consequence of the rise in fuel and other items of expenditure. The winter so far has been a bad one from the point of view of the illumination industries, however pleasant it may have proved to those who suffer from fog. Changes on the week are unimportant, but a better tone in City Lights deserves notice, and there seems to be an idea about that speculation in these may be renewed. That, however, is a matter which only the insiders can prophesy with any attempt at accuracy.

It is a little surprising that investors should not pay more attention to the 4½ per cent. Debenture stock of the Urban Electric Supply Company, which can be bought in the market at about 86¾, with dividends payable on April 1st and October 1st. The amount required every year for the service of the stock is £13,380, and the net profits have risen steadily from £26,000 in 1905 to £47,600 in 1911, while the estimates for the next three years look for further increases. The Company, of course, is not popular, because of its recent unhappy history ; and it is still in debt to the Edmundsons' Electricity Corporation. But for those who care for a stock that yields a steady 5¼ per cent., with a chance of improving in value, Urban Debenture looks reasonably attractive.

The Latin-Canadian group shows several dramatic rises. Montreal Light, Heat and Power put on 10 points. Shawinigan Water Common has risen 6. Brazilian Traction is 4½ to the good. A good deal of strength has developed in Georgia Light and Power shares on the expectation that the first quarterly dividend—at the rate of 4 per cent. per annum—will be declared in March or April this year. A bet was made in the Stock Exchange the other day that Georgias would be 75 before the year is out, but this must not be taken as a tip to buy them.

The British Columbia Electric Railway issue was favourably received, and it had no chastening effect upon the prices of the existing securities—in fact, the company's Preferred Ordinary is up 1, and the 4½ per cent. First Mortgage Debenture stock rose 1½, the publication in the prospectus of the progress which the company has made during the past half-decade, evidently directing fresh notice to the undertaking. The Mexican group is strong, Mexican Light and Power Common being up 1½, while the Preferred and the First Mortgage Bonds are both better. Monterey Fives improved 1½. Mexico Trams and the First Bonds gained 1½ each, and similar rises have been frequent. The Anglo-Argentine Tramways group is steady. Brisbane Trams Investment Ordinary are nominally ⅛ easier. Victoria Falls Preferred hardened to 19s. 6d.

Perth Electric Trams Debenture spurted 5¼ on a small demand. River Plate Electricity Common shed 10 points, there being fears of reduced earnings in consequence of competition.

The Telegraph market is quiet, with comparatively few movements. Eastern Ordinary put on ¼, and Great Northern Telegraphs gained a similar amount. The feature, however, is the strength of West India and Panama Telegraphs : the shares enjoyed a sharp rise on the attitude taken by President Taft on the question of the Panama Canal, and it is devoutly hoped that some arrangement more beneficial to this country than that originally proposed will be arrived at without outside intervention. The Preference shares hardened in sympathy. Western Telegraphs are a little better, and there has been a steady demand for Anglo-Americans, with the result that the Deferred stock at 26⅜ shows a rise of the fraction.

Marconis went ahead in lively mood upon the news that the Brazilian Government had concluded an important contract with the company. The price was run up to 5⅞, from which there was a slight recession, and the shares of the subsidiaries moved on lines very similar—that is to say, after being good they went back a little. National Telephone Deferred is disposed to sag, and the quotation shows a loss on the week.

In the Manufacturing division, Babcocks hardened to 3⅛, and the armament shares generally improved upon the official announcement of the Budget for 1913, with its provision of fifty millions sterling for the Navy. The Cable Companies' shares are better, British Insulated and Henleys both showing gains, while India-Rubbers rose 10s. to 10½ middle. The Rubber share market continues to exhibit surprising strength and vitality, there being a big volume of business every day, and little present indication of its slackening.

Mexican Light and Power Co., Ltd.—The directors have declared a dividend of 1 per cent. for the quarter ending December 31st on the ordinary shares.

Prospectus.—*British Columbia Electric Railway Co., Ltd.*—This company has been inviting subscriptions for £750,000 4½ per cent. perpetual consolidated debenture stock at 98 per cent. The proceeds are to be devoted to extensions and general purposes of the company, which, as the last annual report showed, is developing at a remarkable rate. The list was to close on Wednesday.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME	Stock or share.	Dividends for 1911.	Dividends for 1912	Closing Quotations Jan. 7th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5⅛	5†	9¼ — 10¼	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8⅝ — 9⅝	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10 — 10¼	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98 xd	..	4 11 10
Brompton & Kensington, Ord.	5	10	9†	8¾ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8⅝ — 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95 — 98	..	4 1 8
Charing Cross, West End & City	5	5	5†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅜ xd	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	96 — 99 xd	..	4 10 11
City of London, Ord.	10	8	6†	16 — 18	..	4 9 0
Do. 6 % Cum. Pref.	10	6	6	12 — 13½	..	4 9 0
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 3 4
Do. 4½ % Second Deb.	100	4½	4½	99½ — 101	..	4 9 1
County of London, Ord.	10	6	4†	11⅝ — 12	..	5 0 0
Do. 6 % Pref.	10	6	6	11 — 12⅛	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	104 — 105 xd	+1	4 4 11
Do. 4½ % Second Deb.	Stock	4½	4½	98 — 101	..	4 8 8
Edmundson's, Ord.	£3	Nil	..	⅛ — ¼	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4 — 4½	..	..
Do. 6% Non-Cum. Pref.	5	..	..	1⅛ — 1½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	8†	7⅞ — 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7⅞ — 8⅛	..	5 10 9
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2½	..	1½ — 2	..	3 15 ..
Do. 6 % Pref.	5	6	6	4¾ — 5½	..	5 14 ..
Do. 4 % First Mort. Deb.	Stock	4	4	88 — 91	..	4 8 0
Metropolitan	5	4	4†	3⅜ — 4⅞	..	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4 1/16 — 4 1/16 xd	+ 1/16	5 1 5
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 — 100 xd	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 — 86 xd	..	4 1 5
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97 — 99 xd	..	4 10 11
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅜ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98½ — 101½	..	4 18 6
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅞ — 10⅜ xd	..	5 11 7
Oxford	5	7½	6†	6½ — 6⅝	..	5 9 6
St. James' and Pall Mall, Ord.	5	10	10†	9¼ — 10½	..	4 17 7
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84 — 87 xd	..	4 0 6
Smithfield Markets, Ord.	5	2	..	1⅜ — 1a	..	..
South London, Ord.	4	5	..	2¼ — 2⅝	..	5 18 4
Do. 5 % First Mort. Deb.	100	5	5	96 — 99 xd	..	5 1 0
South Metropolitan, 7 % Pref.	1	7	7	1⅝ — 1⅞	..	5 9 5
Do. 4½ % First Deb. Stock	100	½a	4a	96 — 99	..	4 11 3
Urban, Ord.	£3	Nil	..	¼ — ⅜	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅜ — 3⅛	..	..
Do. 4½ % First Mort. Deb.	100	4½	4a	85 — 88	..	5 2 3
Westminster, Ord.	5	10	9†	8¾ — 9¼	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝ xd	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅝ — 5⅞	..	5 6 8
Calcutta, Ord.	5	8½	7†	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4 1/16 — 5 1/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	92½ — 94½ xd	..	5 5 10
Canadian Gen. El. Com.	$100	7	7	115 — 119 xd	+2	5 17 8
Do. 7 % Pref.	$100	7	7	118 — 122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	5	1 3/16 — 1 5/16	..	5 6 8
Do. 5 % Deb.	100	5	5	95 — 98	..	5 2 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	88 — 91 xd	+4	5 10 0
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95 — 97	— ½	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 1/16	..	Nil
Do. 6 % Pref.	1	6	6	1/16 — 1/16	..	8 14 6
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 — 104 xd	..	4 16 2
Madras, Ord.	5	Nil	..	1½ — 2	..	..
Melbourne, 5 % 1st Mort. Deb.	£20	5	5	100 — 103 xd	..	4 17 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	85 — 87 xd	..	5 15 0
Mexican Lt. & Power, Common	$100	4	4†	85 — 87	+1½	4 12 6
Do. 7 % Cum. Pref.	$100	7	7	105 — 107	+1	6 10 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96 — 98	+1	5 2 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	68 — 70	+ 1½	5 11 1
Montreal, Lt., H. and Power	$100	8	9†	207 — 212	+10	3 14 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	25 — 30	..	..
River Plate, Ord.	Stock	10	..	217 — 227	— 8	4 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 — 111	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	100 — 102 xd	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 — 100	..	4 10 0
Shawinigan Water, Capital	$100	5	5	119 — 123	+6	3 5 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105 — 107 xd	..	4 13 6
Do. 4½ % Per. Deb.	Stock	4½	4½	100½ — 102½	+ ½	4 7 10
Toronto Power, 4½ % Deb.	Do.	4½	4½	98 — 100	— ½	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91 — 94 xd	..	5 6
Victoria Falls Power, Pref.	1	11¾d.	7¾d.	15/16 — 1	+ 1/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103½ — 105½	..	5 13 9

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	7 — 7½	..	6 0 0
Do. 5 % Deb. Red.	Stock	5	5	96 — 98 xd	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8†	141¼ — 143¾ xd	+ ½	5 11 6
Do. Collat. Trust	$1000	4	4	91½ — 93½ xd	..	4 5 7
Anglo-American Telegraph	Stock	8	8	67 — 69	..	4 7 0
Do. 6 % Pref.	Do.	6	6	111⅜ — 112⅝	+ ⅜	5 6 5
Do. Def.	Do.	80/-	..	26½ — 26⅞	+ ⅜	5 15 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	..	4 16 2
Chili Telephone	5	7	8	7⅛ — 7⅜ xd	..	5 3 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	80 — 82 xd	..	4 17 7
Cuba Telegraph	10	6	6†	8½ — 9½	..	6 6 4
Do. 10 % Pref.	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3⅛ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅝ — 7	..	7 2 10
Direct United States Cable	10	5	4	6⅞ — 7⅛	— ⅛	6 15 7
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 — 101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	133½ — 136½	+ ½	5 2 7
Do. 8½ % Pref. Stock	Do.	8½	8½	77 — 79	..	4 8 7
Do. 4 % Mort. Deb.	Do.	4	4	96½ — 98½	+ ½	4 1 8
Eastern Extension	10	7	7†	18 — 18⅜	..	5 3 8
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 — 101	..	3 19 8
Globe Telegraph and Trust	10	6	6†	10⅜ — 10⅞	..	5 10 4
Do. 6 % Pref.	10	6	6	12⅜ — 12⅞	..	4 13 2
Great Northern Telegraph	10	18	18	28 — 30	+ ½	6 0 0
Indo-European Telegraph	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common	$100	5	5	85 — 88	..	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	4 1/16 — 5	+ 1/16	4 0 0
Do. 7 % Cum. Partic. Pref.	1	17	..	4¼ — 4½	+ ¼	3 15 7
Monte Video Telephone, Ord.	1	6	6†	1⅛ — 1 1/16	..	5 13 0
Do. 5 % Pref.	1	5	5	13/16 — ⅞	..	5 18 6
National Telephone Def.	Stock	6	..	136 — 139	— 1	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	97⅜ — 98⅜	..	4 11 2
Oriental Telep. and Elec.	1	8	6†	1⅜ — 1 5/16	..	4 9 10
Do. 6 % Cum. Pref.	1	6	6	1 5/16 — 1 3/16	..	4 18 6
Do. 4 % Red. Deb.	Stock	4	4	87 — 89 xd	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100 xd	..	4 0 0
Reuter's	10	10	10†	10½ — 10⅝	— ½	9 6
Submarine Cables Trust	Cert.	6	6	127 — 130	..	4 12
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	97 — 99 xd	..	4 10 1
United River Plate Telephone	5	8	..	7 1/16 — 7 1/16	..	5 4 1
Do. 5 % Cum. Pref.	5	5	5	5 1/16 — 5 3/16 xd	..	4 7 11
West Coast of America	2½	2½	..	1 1/16 — 1 1/16	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	95 — 98 xd	..	4 1 8
West India and Panama Teleg.	10	2½	1½†	3 5/16 — 3 7/16	+ 1/16	..
Do. 6 % Cum. 1st Pref.	10	6	6	10¼ — 10¾	+ ⅛	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 — 103 xd	..	4 17 1
Western Telegraph, Ltd.	10	7	7†	15⅛ — 15⅝	+ ⅛	5 2 9
Do. 4 % Deb.	Stock	4	4	94 — 96 xd	..	4 3 4
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	97½ — 100½	+ ½	4 10 0

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Jan. 7th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅜ — ⅝	..	Nil
Do. 5 % Pref.	1	5	5	1 1/16 — 1 1/8 xd	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 5 % Pref.	100	..	..	11½ — 13¼	..	..
Do. Do. Deferred	100	..	..	5 — 7	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 90	..	6 13 4
Do. 7 % Non-Cum. Pr'f.	100	..	..	39 — 42	..	..
Do. 5 % Perp. Deb.	100	5	5	92 — 96	..	5 4 2
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81	..	5 7 2
Central London Railway, Ord.	100	8	8†	82 — 84	..	9 11 5
Do. Pref.	100	4	4	83 — 85	..	4 14 2
Do. Def.	100	2	..	83 — 85	+1	2 7 1
Do. 4 % Deb.	100	4	4	98 —100 xd	..	4 0 0
City & South London, Ord.	100	1⅜	1½†	36½ — 37½	+ ½	3 13 4
Do. 5 % Pref., 1891	100	5	5	109 —111	..	4 10 1
Do. Do. 1896	100	5	5	109 —111	..	4 10 1
Do. Do. 1901	100	5	5	109 —111	..	4 10 1
Do. Do. 1903	100	5	5	109 —111	..	4 10 1
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅛ — 2⅜	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	1⅜ — 2⅜	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	75 — 80 xd	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	73 — 80 xd	..	6 5 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97 xd	+1	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	5 — 6	..	..
Do. 4 % Deb.	100	4	4	69 — 72 xd	..	5 11 1
Metropolitan Railway Consol.	100	1⅝	1½†	54⅜ — 55½	+1⅜	2 18 10
Do. Surplus Lands	100	2⅛	2½†	62 — 64	..	4 6 0
Do. 3½ % Deb.	100	3½	3½	88 — 90	+1	3 17 9
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	Nil	42⅜ — 43¼	+2⅛	Nil
Do. 6 % Deb.	100	6	6	139 —141 xd	..	4 4 0
Do. 4 % Deb.	100	4	4	93 — 95 xd	..	4 2 6
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 8
Do. 4½ % First Pref.	100	4½	4½	89 — 91	+1	4 18 11
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	6	5†	1 1/16 — 1 1/8	..	5 1 1
Do. Def.	1	Nil	..	¼ — ⅞	..	Nil
Do. 5 % Pref.	1	5	5	⅞ — 1	..	5 14 3
Do. 4½ % Deb.	100	4½	4½	91 — 93 xd	..	4 14 9
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Potteries, Ord.	1	3½	..	⅞ — 1	..	..
Do. 5 % Pref.	1	5	5	1 — 1⅛	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	86 — 88	..	5 2 3
South Metro. Trams, 6 % Pref.	1	6	..	1⅛ — 1⅜	..	7 7 8
Do. 4 % Deb.	100	4	4	65 — 70 xd	..	5 14 4
Underground Elec. Railways	10	..	..	4⅜ — 4⅝	+ ⅛	Nil
Do. "A"	1/-	..	..	3/32 — 4/32	+ 1/32	..
Do. 6% First Cum. Inc. Deb.	100	..	6	111 —113	..	5 6 2
Do. 4½ % Bonds	100	4½	4½	98 —100 xd	..	4 10 0
Do. 6 % Income	100	1½	£2	94 — 95	+1½	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ⅜	..	Nil
Do. 6 % Pref.	5	3	3†	3 — 3⅛ xd	..	4 5 9
Do. 4½ % Deb.	100	4½	4½	77 — 81 xd	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅜ — 5 xd	..	5 10 0
Do. 2nd Pref.	5	5½	5½	4⅜ — 4½ xd	..	5 14 3
Do. 4 % Deb.	100	4	4	92 — 94 xd	..	4 5 1
Do. 4½ % Deb.	100	4½	4½	97 — 99 xd	..	4 10 11
Do. 5 % Deb.	100	5	5	98 — 100	..	5 0 0
Auckland Trams, 5 % Deb.	100	5	5	101 —103 xd	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	11⅛ — 12½	..	4 18 0
Do. 4½ % Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99 xd	..	5 1 0
Brazilian Traction Light and Power	$100	..	..	98 —100	+4½	..
Brisbane Trams Invt., Ord.	5	8	8†	6⅝ — 7⅜	— 1/16	5 8 6
Do. 5 % Pref.	5	5	5	4⅝ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	99 —102 xd	..	4 8 3
B. Columbia Elec. Rly., Def.	100	8	..	139 —144	..	5 11 2
Do. Pref. Ord.	100	6	6	119 —123	+1	4 17 7
Do. 5 % Pref.	100	5	5	107 —110	..	4 10 11
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	+1½	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	97 —100	..	4 5 0
Calcutta Trams, Ord.	5	7	5†	5⅜ — 6⅛	+ ⅛	5 12 0
Do. 5 % Pref.	5	5	5	4 1/16 — 5 1/16 xd	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
Cape Electric Trams	1	2½	..	⅜ — ⅝	..	..
City Buenos Aires Trams (1904)	5	5	5†	5 7/16 — 5 9/16	..	4 8 0
Do. 4 % Deb.	100	5	5	97 —100 xd	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 2 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	88 — 88 xd	..	5 13 8
Do. 6 % B Deb.	100	6	3	30 — 40	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	17/32 — 21/32	..	..
Do. Pref.	1	6	..	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1¼	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1¼ xd	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 95 xd	..	5 5 3
Madras Elec. Tr. (1904), Deb.	100	5	5	100 —102	+2	4 18 0
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 90 xd	..	5 11 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	112½—114½	+1½	6 2 3
Do. Gen. Con. 5 % Bonds	..	5	5	97½— 99½	+1½	5 0 6
Do. 6 % Bonds	100	6	6	100½—102½ xd	..	5 17 1
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7½ — 7¾	..	6 9 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	98 —100	+ ½	5 0 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1 3/32 — 1 5/32	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	103 —106 xd	+5/8	4 14 4
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝ xd	..	5 6 0
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99 xd	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	100 —102 xd	..	4 18 0
Do. 5 % Mort. Bonds	100	5	5	96½ — 98½	..	5 1 6
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	102½—104½	+ ½	4 15 8
Singapore Trams, 5 % Deb.	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	+1	5 2 0
Un. Elec. Trams Monte Video	5	7	6†	5⅛ — 6	..	6 16 8
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	3/16 — 5/16	..	8 0 0
Do. 6 % Pref.	1	6	6	1/16 — 1/8	+1/32	7 7 8
Babcock & Wilcox	1	28	14†	3 1/16 — 3 1/8	+ 1/8	4 14 0
Do. Pref.	1	6	6	1⅛ — 1⅜	..	4 0 0
British Aluminium, Ord.	1	Nil	..	3/16 — 5/16	..	..
Do. 6 % Cum. Pref.	1	Nil	..	11/16 — 13/16	..	..
Do. 5 % Prior Lien Debs.	100	5	5	89 — 92 xd	..	5 8 8
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	7⅜ — 8¼	+ ⅛	6 3 1
Do. Pref.	5	6	6	5⅝ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	102 —104 xd	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref.	3	Nil	Nil	⅜ — ⅝	..	Nil
Do. Deb.	100	4	4	58 — 61 xd	..	6 11 2
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	73 — 78 xd	..	6 8 2
Do. 4½ % Deb.	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb.	100	4½	4½	28 — 32 xd	..	14 1 4
Callender's Cable	5	15	10†	10½ — 11½	..	6 13 4
Do. Pref.	5	5	5	4½ — 5 xd	..	5 0 0
Do. Deb.	100	4½	4½	97 —100 xd	..	4 10 0
Castner-Kellner	1	20	20	33 — 33½	..	5 6 8
Do. Deb.	100	4½	4½	106 —109	..	4 2 7
Crompton & Co.	5	Nil	..	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	53½ — 55½ xd	..	9 1 10
Dick, Kerr	1	5	Nil	1/16 — 1/8	..	..
Do. Pref.	1	6	6	¼ — ⅜	..	6 17 2
Do. Deb.	100	4½	4½	95 — 98 xd	..	4 11 10
Edison & Swan, A, £8 paid	5	Nil	..	⅛ — ⅜	..	Nil
Do. fully paid	5	Nil	..	1 — 1¼	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68 xd	..	5 17 8
Do. 5 % Second Deb.	100	5	5	72 — 75	..	6 18 4
Electric Construction	2	2½	3½	1 1/16 — 1 1/16	..	7 1 4
Do. Pref.	2	7	7	1⅞ — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	9½ — 10⅜ xd	..	..
Do. Deb.	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12½ — 13½	+ ¼	6 8 4
Do. Pref.	5	4½	4½	4⅝ — 5⅛	+1/16	4 7 10
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	..	7½	10 — 11 xd	+ ½	6 16 4
Do. Pref.	10	5	5	9½ — 10⅜ xd	..	4 17 7
Telegraph Construction	12	17½	5†	84½ — 86½	..	5 13 0
Do. Deb.	100	4	4	95½ — 98½ xd	..	4 1 8
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	½ — ¾	..	Nil
Do. Deb.	100	4	4	57 — 59	..	6 15 7

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

INVENTORY OF PLANT IN MUNICIPAL ELECTRICITY WORKS.

BY "INTERESTED."

"I WANT an inventory of all plant installed purchased from capital, together with a certificate signed by the engineer, stating that the whole is in commission and of useful service as means of profit earning." A tall order that; and there is more in it than meets the eye at first glance, too. It is one of the latest requests made by our old friend, Mr. Auditor, for a certified detailed statement of the value of plant actually in commission, and not merely of scrap value only. In reality, the request amounts to a guarantee that machinery, boilers, auxiliary apparatus, mains, switchgear, &c., are not standing idle awaiting the precise moment when their particular loan is redeemed, in order to be relegated to the scrap heap.

In most stations owned by local authorities the absence of detail records in the early period of their existence accentuates the difficulty now experienced in preparing a true statement of the whole capital expenditure in detail, and likewise that of allocating expenditure to each separate mortgage. Speaking generally, loans have ever been increasing; repayments have been made over varying periods at many different rates of interest; and occasionally here and there small loans have been redeemed, more through force of circumstances than otherwise. Some works have plant installed purchased from revenue and, perhaps, small floating balances of loans on account of plant scrapped, in order to make room for that purchased from revenue. Mr. Auditor requests all these transactions properly and clearly set out in tabulated form.

In some cases a systematic balancing-up for the purpose of preparing a detailed summary of capital account reveals the necessity for immediately writing off numerous small outstanding amounts. This procedure is caused by the fact that goods for which loans have been taken up either cannot be justly certified as useful profit-earning units, or have entirely disappeared owing to various causes.

What seems now to be imperative is a clear, lucid, up-to-date statement of capital expenditure and redemption made up from the commencement of the undertaking. Just how this should be done, and the best manner of showing the present state of affairs, is rather a vexed question. In this short article I propose illustrating one method for carrying out the work, which may prove of use to not a few readers.

The whole matter is in the form of a book printed and ruled after the fashion illustrated below. This is in actual use in a certain London station, and will, I think, with little alteration, prove suitable for many others. The pattern runs right across each opening, and a four-letter index at the front of the book serves the purpose of enabling any particular item to be found without delay. In the pattern shown a few imaginary figures are filled in for the purpose of explanation. As will be seen, entries are made and a balance shown annually, so that once the bulk of information is collated, very little time is needed to keep the record up to date. The right-hand side of the illustration is really of a revenue nature, but serves the purpose of showing the amount expended over and above depreciation, *i.e.*, repayment of capital, so that the true value of the plant as it stands can be ascertained (see illustration No. 1).

The repairs and maintenance, or revenue, side of an undertaking is one affecting the engineering staff generally, and the "Chief" in particular. He it is who frequently requests information respecting repairs executed upon the different plant units of which the whole works is composed. In order to be in a position to present such information immediately it is called for, without unnecessary delay and a hurried search through innumerable log-books, sheets, &c., a systematic entry of important breakdowns, repairs and replacements is obviously necessary: not simply a conglomeration of foolscap sheets of writing and figures arranged in no particular order, with an index noticeable by its absence, but a simple, quick and ready means of recording occurrences. Such a system

DESCRIPTION OF PLANT: No. 12 B. & W. BOILER FITTED WITH MECHANICAL STOKERS.

Nos. and Marks. BR. 12 & 12A.

Date.	Work calling for attention.	E-in-C's initials	Date.	Work done.	Remarks.	Engr's Sig.
23/1/12	Left-hand furnace arch wants repairing	A. P.	6 to 9/2/12	Boiler cleaned out. Wire brush through tubes.	Tested and found all O.K.	
4/2/12	Plug of blow-down cock leaking.	J. W.		B.D. cock overhauled and repacked.	5 p.m.	
				New gauge glass protectors fitted.	9/2/12.	J. R.
				Brickwork L.H. arch repaired.		

No. 2.

should be arranged so that anyone can refer thereto easily and quickly, and find there briefly described all work of much account in the nature of repairs, replacements, renewals and alterations made from time to time. Also there should be added notes of any work calling for attention at the first possible opportunity.

I do not suggest that every minute detail is or should be recorded, but merely work of sufficient size and importance, reference to which at any later time might conduce to a saving in time or material. In order to afford a clear illustration let me take a concrete example by way of explanation. A battery of say five boilers is "off" for some trivial repairs, opportunity being taken at the time to clean them internally. Whilst it is impossible thoroughly to overhaul the five boilers in such a short period, there are most likely a few points which require examination, and time and worry will be saved by reference to notes (which would be found in the below-mentioned system) in order to observe those few important details demanding attention. A casual examination will suffice generally for other points provided the annual period for thorough examination is not near at hand, for if anything worthy of attention was noticed during the time these boilers were in commission previously to being temporarily shut down, note would certainly be found in the proper place in the system. A glance at the five places in the book, *i.e.*, one for each boiler, would reveal all that should receive attention.

The arrangement is simply a foolscap book of about five quires, with printed headings, as per illustration No. 2. One page is allotted to each unit in the works, and entries are made from time to time, whenever necessary. The last column is for the signature of the engineer or works superintendent directly the repair, alteration or replacement is

General Description.—3,500-KW. turbo-alternator.
Detail Description.—Turbine, by Williams & Co.
Alternator, by Brown & Co., Ltd.
H.T. motor-driven exciter, by Electrics, Ltd.

Total value, £9,400.
Mortgage Nos., 146 and 147.
Period for repayment, 20 and 15 years.
No. and marks, E20, E21.

Remarks.—Foundations included in capital value.
Balance of £3,000 paid out of revenue.

Date.	Item No.	Capital value.	Instalment No.	Redemption.	Balance.	Revenue.	Depreciation 10 %.	Balance.	Total capital and revenue.
31/3/11	1	£6,000 0	1/20	£300 0	£5,700 0	Balance paid from revenue	£3,000	£300	£2,700	£8,773 12
	2	400 0	1/15	26 8	373 12				
		£6,400 0		£326 8	£6,073 12				
31/3/12	1	£5,700 0	2/20	£300 0	£5,400 0	do.	£2,700	£300	£2,400	£8,147 4
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No. 1.

made. An index is, of course, included at the front of the book.

This simple book will be found quite adequate to meet all demands, whereas entries in a daily or weekly log book fail to show the required information at the right time. The details require summarising and analysing, and putting forward in such a way as to be observed at the right time.

In effect, this revenue plant record is a summary of the log book, with notes and instructions added, and from this book particulars are abstracted for entering on the right-hand side of the above-mentioned Plant Inventory.

"GENTLEMEN—WE THANK YOU!"

How the Good News came to Hong-Kong.

By PROF. C. A. M. SMITH, M.Sc.

"The Mail is in!" We heard the boom of the gun about two hours ago, and even the Chinese undergraduates, who are but slightly interested in mails, looked up from their drawing boards to take a glimpse of the great liner as she slowly steamed among the junks and sampans which cover the most wonderful harbour in the world. There are 37 of these engineering undergraduates—when last I wrote, in October, there were only 25, but the score climbs steadily up. How long before we reach 500? If the present symptoms can be taken as indicative of what the Chinese mean to do, it will not be very long before Hong-Kong is as famous in China for its University as is Cambridge in England. We have 37 engineering students out of a total new entry of 55. That is as it should be. Medicine and other subjects are being, and will be, studied by the Chinese. But what the nation seeks after, as a thirsty man seeks something for his parched lips, is applied science. We offer them that in full at this University.

The Great Day.

"The mail is in." As soon as I could, with decency, leave the drawing office, I hastened to my room. Yes, there was the familiar bundle—the good old Electrical Review. Had it published my appeal? Had it backed it with the incisiveness of the pen which the Editor or some of his staff keep stowed away in a special cupboard above which must be writ large King George's watchword, "Wake up, Eng'and!"? These, and a thousand other, thoughts rushed through my brain as I tore open the wrapper, and then—

Then I knew that the spade work—the digging in the trenches—of the last few weary months had not been in vain. For I opened the blue cover and I turned to the index . . . but before I did so I saw the word "China" on the page which is sacred to the statement of editorial policy. And I knew that whoever else failed us, the great-hearted friend in Ludgate Hill was true. And a wave of feeling swept over me, such as I suppose comes to few men, for never before had it been my lot to carry anxiety single-handed, or to feel responsibility to such extent that it seemed impossible to win success. And now the message had come. After all, those at home had answered the call! Now can we go forth boldly into the struggle once again. China is hungry for knowledge—yes, but we will supply it, and the British Empire shall still lead in the teeth of twentieth-century competition.

"Do it Now."

I frankly confess that there are lines—the closing lines—in the leader which ought never to have been written. But I cannot find it in my heart to upbraid the Review after its magnificent appeal. That clarion call has been echoed up and down the China coast, and now we who are at work for the future know that we can rely upon those at home to help us.

But there are yet readers of the Review who have done nothing. Ponder over the following extract from the Hong-Kong *Daily Press* of October 28th:—"The University is already a success beyond the dreams of its most sanguine sponsors. . . . The majority of the first-year students at the University have elected to be trained in Engineering Science. That is only what we expected. China needs above all else, at the present time, and will continue to need for very many years to come, engineers for waterworks, the development of her mines, the extension of her railways and other modes of communication, so that the trade of this great country can be effectively opened up. The need of engineers is recognised in China."

Reader, what have you done? Have you thrown aside this golden opportunity—it will never return—to advertise your goods in the Far Eastern market? Won't you strike a blow for freedom and progress? Send that cable or write that letter which will tell us in this little island by the Canton River that you recognise your responsibilities. *Do it now!*

Let me take this opportunity to pay my humble tribute to the British Engineers' Association, whose coming will be greatly welcomed in China. To it we look for substantial help, and I can now suggest that it should endow one of our chairs when it is firmly at work.

It is because I am certain that the electrical firms of Great Britain will see to it that we have an electrical equipment in the beautiful laboratories of this University, that I say with heartfelt gratitude, "Gentlemen, we thank you!" We have done our work for you out here; we are cutting through the jungle of ignorance and superstition. Under the tropical sun we are carving for you a pathway that you and your countrymen may use. If you have not already sent that cable or written the letter—please, for the love of your profession, for the love of your country, for the sacred cause of scientific progress, Do it now. What matter your doubts, write—we will advise.

NATIONAL INSURANCE ACT, 1911.

Further Decisions of the Umpire. Refundment of Contributions. Quarterly Stamping.

By JOS. J. H. STANSFIELD, F.C.I.S.

In the Electrical Review of August 16th and October 4th last the decisions of the Umpire appointed under the provisions of the Unemployment Part of the National Insurance Act, 1911, were given, and the present article brings up the decisions to the close of 1912.

The rush of applications to the Umpire appears to be over. From May 16th to June 27th 223 decisions were advertised in the *Board of Trade Journal*, whilst the decisions given therein for the quarters ending September 30th and December 31st, 1912, were 846 and 158 respectively, bringing up the total decisions to the end of the year to 1,227.

The numbers in various sections follow on from the previous articles.

Mechanical Engineering.—Contributions are payable in respect of the following:—

27. Hoistmen or lift attendants (for passengers or goods) employed in factories and workshops, or in stores immediately connected therewith (but not in offices), when the aforesaid factories and workshops are engaged wholly or mainly in carrying on any of the trades set out in Schedule VI of the National Insurance Act, 1911 (A. 1,088). (Note.—Mechanical engineering is one of these trades.)

28. Labourers engaged in assisting millwrights, either in excavating foundations for the erection of engines or machinery, or in dismantling machinery or otherwise (A. 1,105).

29. Workmen and their helpers and labourers employed in factories and workshops which are engaged wholly or mainly in the manufacture of castings of aluminium for use as parts of the products of a mechanical engineering establishment (A. 1,110).

30. Workmen employed in businesses carrying on an insured trade, and engaged wholly or mainly in setting out the work in detail from the architect's or draughtsmen's

drawings on board, paper or other material, or in making working sketches from the drawings for the use of the workmen and not engaged wholly or mainly as supervising foremen (A. 1,124).

31. A workman described as a locomotive crane driver and engaged wholly or mainly in loading or unloading materials in a wharf siding forming part of a mechanical engineering establishment (A. 1,132).

32. Workmen engaged in making metal patterns for the use of iron, steel, brass or other foundries which are engaged wholly or mainly in making castings for use as parts of the products of a mechanical engineering establishment (A. 1,139).

33. Workmen employed in a mechanical engineering establishment and engaged wholly or mainly in repairing and screwing couplings and chains as part of the work of making or of repairing vehicles, cranes and machinery (A. 1,141).

34. A workman described as an inspector employed in a mechanical engineering establishment wholly or mainly in testing materials with straight-edge and other gauges (A. 1,160).

35. Tube benders employed in a mechanical engineering establishment (A. 1,163).

36. Twiners and other machinists engaged wholly or mainly in producing ebonite or vulcanised fibre parts for use as parts of the product of a mechanical engineering establishment (A. 1,169).

37. Workmen engaged wholly or mainly in connection with insured trades and employed as sketchers and progress men (A. 1,212).

38. Workmen engaged wholly or mainly in making, finishing or fixing ferro-concrete and artificial stone in connection with any insured trade, whether on the site or in a workshop or yard (A. 1,216).

39. Workmen engaged wholly or mainly in making moulds for ferro-concrete or artificial stone mentioned in A. 1,216 (A. 1,217).

40. Workmen engaged wholly or mainly as tool setters for general brasswork on capstan lathes and machine tools (A. 1,219).

41. Workmen employed in a mechanical engineering establishment and engaged wholly or mainly in machining and assembling metal windows (A. 1,225).

42. Workmen engaged in marking out timber in connection with an insured trade (A. 1,227).

Contributions are *not* payable in respect of—

11. Workmen engaged in making metal patterns (other than cast-iron patterns) not being for the use of iron, steel, brass or other foundries, who are engaged wholly or mainly in making castings for use as parts of the products of a mechanical engineering establishment (B. 1,138).

Electrical Engineering.—Contributions are *not* payable in respect of—

43. Workmen engaged in making lead accumulator boxes or lead linings for accumulator boxes (B. 1,134).

44. Workmen engaged wholly or mainly in wiring electroliers and similar electrical fittings, and not engaged in the installation or fixing of same (B. 1,150).

45. Workmen engaged wholly or mainly in making ebonite or vulcanised fibre parts of scientific instruments, telephones, or electric light fittings (B. 1,170).

Cables, Overhead Lines, and Street Lighting.—Contributions are payable in respect of :—(4) Workmen engaged wholly or mainly in driving or attending steam road rollers in connection with the construction of new roads, and not merely the resurfacing of existing roads (A. 1,076).

Contributions are *not* payable for :—(18) Workmen engaged wholly or mainly in making sills for lids of manholes in streets (B. 1,089).

Generation and Supply of Energy.—Contributions are payable in respect of :—

7. Workmen engaged in erecting and connecting necessary wires to run and control electric time service (A. 1,115).

Contributions are *not* payable for :—

15. Chauffers employed wholly or mainly in driving and cleaning motor-cars and in doing occasional adjustments and repairs thereto (B. 1,108).

Tramways.—Contributions are payable in respect of :—

9. Workmen employed in a vehicle constructing or repairing establishment, and engaged wholly or mainly in repairing and screwing couplings and chains as part of the work of making or of repairing vehicles, cranes and machinery (A. 1,141).

Refundment of Contributions.—The Unemployment Part of the Insurance Act, by Sec. 94, provides that the Board of Trade shall, on the application of any employer, made within one month after the termination of any prescribed period of 12 months, refund one-third of the contributions paid by him on his own behalf in respect of workmen who have been continuously in his service during the period and in respect of whom not less than 45 contributions have been paid during the period.

A refund of contributions paid in respect of unemployment insurance may also be claimed under Sec. 96, where any employer satisfies the Board of Trade that during any period of depression in his business his workmen have been systematically working short time and he has paid the workman's share of the insurance in addition to his own.

Sec. 100 of the Act provides that any regulations made by the Board of Trade must provide for the return to a workman who is not in an insured trade, and to his employer, of any contributions paid under the belief that the workman was in an insured trade, subject, of course, in the case of a workman, to the deduction of any unemployment benefit that may have been paid.

Forms to be signed by workmen and employers applying for the return of contributions paid in error may be obtained from Labour Exchanges.

No provision is made in the Health part of the Insurance Act for the repayment of contributions paid in error, but upon application being made to the Commissioners, forms can be obtained to claim repayment.

Quarterly Stamping.—A revised circular with respect to the quarterly stamping of Contribution Cards has been issued (Circular No. 105 (3)) by the English Health Commissioners. The alterations are not serious, the main one being that where there are less than 100 employés, Methods 3 and 5 (see ELECTRICAL REVIEW of November 8th, 1912) will not be approved. These methods allow for weekly cheques being sent to the Accountant-General, instead of depositing the whole quarter's contribution in advance.

REVIEWS.

Vapours for Heat Engines. By W. D. ENNIS. London: Constable & Co., Ltd. 1912. Price 6s. net.

This is a very thorough investigation into the theory of what it has been customary to call the binary vapour engine. This binary engine is very tempting to the untutored engineer, who knows that certain liquids boil at a lower temperature than water, and give greater pressures at lower temperatures. But these are not the only desiderata, and when we learn that the few vapours which are, under circumstances, better than steam, are those of alcohol, chloroform, acetone, carbon bisulphide and carbon chloride, our joy in binaries, or even in the primary use of these liquids, is somewhat tempered. Was not carbon chloride the stuff, or something like the stuff, that was used by one Guittari as an economical liquid ?*

The author has worked out a series of curves, giving the pressure-temperature relations of what he terms the engineering vapours—ammonia, sulphur dioxide, ether, CS_2, acetone, chloroform, carbon chloride, ethyl alcohol, and steam. Except the last two in suitable combination, they do not sound attractive to engineers, but are more reminiscent of the operating theatre. They are at least dangerous. Of all the vapours that of steam has the least pressure for a given temperature, and its best ideal efficiency at modern temperatures is at present 0·47 ; the best recorded efficiency is 0·25, or little over half the theoretical.

The author attacks the problem on the grounds that (1) another vapour might give a higher temperature at 250 lb. pressure (the present steam limit) without superheat ; or (2) a temperature of 600° with superheat might

* Guittari used a mixture of carbonic acid gas and ethene chloride.—EDS. ELEC. REV.

give an efficiency better than steam ; or (3) at 28 in. vacuum a lower temperature might be attained.

No vapour is known that will fill the first two conditions, which demand a $t\,p$ curve crossing that of steam. Other vapours do cross, as ethyl alcohol and carbon chloride at 190° F. It is easy to meet condition (1), but not at the same time (3). Condition (3), in any case, is dependent upon a supply of cooling water at, say, 60°, and then the limit of efficiency for any vapour would be 0·51, or 8 per cent. over present steam limits.

Only four vapours fit this condition (3), namely, carbon bisulphide (poisonous and offensive), chloroform (dangerous), acetone, carbon chloride, and possibly a fifth—alcohol. The best is carbon chloride with a pressure of 88 lb. at 302° F. as compared with 69 lb. for steam, and the pressure curve may even cross that of steam at 400° F.

Between 302° and 68° steam stands first in order of merit as a first approximation, but only four of the vapours could be condensed down to 68°, and both alcohol and steam would be slightly inferior to the other four vapours. If high initial pressure is got by superheat no advantage appears to be possible with the four vapours, and steam and alcohol stand first. The author finds no advantage in the binary principle to offset its complications.

For the whole of the six vapours named there is not an enormous difference in the relative sizes of either the boiler or the condenser, but considerable differences are found in the time to get up steam. In Chapter XI the author finds with the so-called Rankine cycle that the cycle efficiency may decrease with an increase of temperature range. With three of the vapours an engine will give equal power with a steam engine of nearly and fully double the cylinder capacity, when working with four expansions.

The substitute vapours probably lose more than steam in cylinder condensation effects, and they have very heavy pressures which are balanced, it may be to some extent, by the possible use of smaller cylinders.

There appears nothing "inherently absurd" in the use of vapours other than steam, and their use, as the primary liquid, is more promising by far than their use as binary vapours heated by the exhaust from a steam engine. We regard this as a very useful book for the student who might be led away by too much enthusiasm for other vapours. There is very little that can be said on behalf of them, and when their various characteristics are taken into the balance, there does not appear to be any real balance in their favour as compared with steam.

Studies in Radio-activity. By W. H. Bragg, M.A., F.R.S. London : Macmillan & Co., Ltd. Price 5s. net.

This book deals chiefly with the phenomena attending the passage of the α, β, and γ or X-rays through matter. It embodies a record of experiments carried out in this branch of radio-activity by the author, together with an account of what has been done in this particular field by other investigators. It is, therefore, not a text-book on radio-activity in a general sense, but an account of a more or less limited portion of the subject only. The author has been struck by the absence of any evidence of true secondary radiation, that is, of an ionising radiation which derives its energy from matter under the prompting of primary rays. He concludes, as a result of his investigations, that we can claim no power of causing the atoms to unlock and distribute any stores of energy they may possess. This, of course, is also the conclusion of many other experimenters, though there are some who are not quite satisfied. The author also considers it remarkable that there should be so little evidence of the influence of molecular association upon radio-active phenomena. When an atom acts upon a passing α or β or γ-ray, it is unsupported by any other atom, even of those belonging to the same molecule.

Particular attention is drawn to the strong family likeness which the three types of radiation, α, β and X or γ-rays bear to each other. The α-rays are positively charged, the β-rays negatively, the X or γ-rays are uninfluenced by electric or magnetic fields. But putting aside these differences and their immediate consequences, in their laws of penetration and scattering, in their actions on matter, and the reactions which they suffer themselves, the three forms of radiation differ in degree rather than in kind. If it is assumed that the action of each form is direct and requires no assistance from any other form, it is difficult to believe at the same time, that the α and β radiations are corpuscular, and that the X and γ-rays are spreading pulses in the ether. The author comes to the conclusion that the assumption is wrong, and that the X and γ-rays act only through the intervention of the β-rays. He finds that this is accomplished by means of a complete interchangeability between the X or γ-ray on the one hand, and the moving electron on the other, a change which may be brought about during the passage of the ray or the electron through the atom. He shows that such a change must take place with little or no loss of energy.

The somewhat original conception of the interchangeability of the two primary rays is then declared to lead to a corpuscular hypothesis of X and γ-rays ; and this is said to be convenient, as the ether pulse idea has been for some time unproductive. It is better, therefore, to put it aside provisionally, and take the interchangeability of the X-ray and the electron as a new starting point.

From the preliminary sets of experiments the following conclusions are drawn :—

1. The α particle is not appreciably scattered in passing through matter, but is "absorbed" only through the expenditure of its energy on ionisation.

2. The α particle has a definite range in any given material depending upon its initial velocity.

3. Radium in a state of equilibrium contains four substances, each of which ejects α particles at the same rate, but with different initial velocities.

4. The range of the α particle of radium itself is about 3·3 cm.

5. The α particle produces more ionisation as its speed diminishes.

Chapter II describes the range-finding apparatus. Chapter III shows how the ionisation curve of the α-ray is obtained. Chapter IV gives an interpretation of certain peculiarities of the α-ray curve. Chapter V deals with the quantitative results of stopping power exhibited by matter to the rays. Chapter VI is on the ionisation produced by the α particle in different gases. Chapter VII deals with initial recombination ; Chapter VIII, with the β-ray and the law of its scattering ; Chapter IX, with the loss of energy of the β-ray ; Chapter X, with the general case of "absorption" of the β-ray ; Chapter XI, with the general properties of X and γ-rays ; Chapter XII, with the production of the secondary β-ray by the X-ray ; Chapter XIII, with the corpuscular form of the X-ray ; Chapter XIV, with the energy of the X-ray ; Chapter XV, with the calculation of the ionisation current under given conditions ; Chapter XVI, with the scattering of X and γ-rays ; and Chapter XVII, with the nature of X and γ-rays.

The book is well worth study by those interested in the subject, as it is evidently the record of an able experimenter.

Electrical Injuries. By C. A. Lauffer, M.D. London : Chapman & Hall. Price 2s. net.

This little book is the work of the medical director of the relief department of the Westinghouse E. & M. Co., Pittsburg, and deals with the causation, prevention and treatment of electrical injuries in a manner to be understood by electrical men. Having acquired great experience and trained 1,000 men in the methods of artificial respiration, the author is well qualified to handle this subject, which is constantly growing in importance. He deals first with flash burns, which are not necessarily very dangerous, but need very careful treatment, and the author gives full details of the proper methods. Under this head are included "flashed eyes," a condition which can be developed by exposure of the eyes to arcs even at a considerable distance, as many an inquisitive electrical neophyte has learnt by painful experience. Burns of the skin are more serious on account of the danger of bacterial infection, which is sometimes fatal. The strangely contradictory phenomena that are met with, such as death from a shock at 110 volts and recovery from one of 15,000 volts, are noted, and a case is quoted in which a lineman died of pure fright on touching a high-voltage line which was not charged at all. Full

instructions are given for the resuscitation of victims of shocks, according to the Schaefer method, which is strongly recommended. An electrician in the employ of the Westinghouse Co. has rescued six lives by this means in as many years, not losing one case. Extreme promptitude in commencing the treatment is of the utmost importance. Short sections are given on minor surgery and first aid, and on infections, and the author concludes with a much longer one on the effects of occupation on health, one of the best in the book. Every engineer in charge of electrical works or machinery ought to have a copy of this excellent manual and make himself familiar with its contents, and everyone without exception ought to be acquainted with the teachings of the last section.

Examples in Applied Electricity. By G. C. LAMB, M.A., B.Sc., Cambridge University Press. Price 2s. 6d. net.

This collection of examples has been compiled mainly from tests set to engineering students at Cambridge, and includes some good exercises, both numerical and graphical, on electrical machines, transformers and power distribution. Probably most engineering colleges possess as useful a set of examples in a more or less collected form, and most teachers would map out exercises on the lines of their own lectures in preference to adopting those of another school.

So far from encouraging originality and experimentation, the publication of such sets of examples would appear to tend rather to the stereotyping of engineering courses and ultimately to the stereotyping of electrical engineers. It must, however, be admitted that this particular book contains examples of a really practical type, which is perhaps a tolerably good excuse for its existence.—P.H.S.K.

PROCEEDINGS OF INSTITUTIONS.

Tramway Feeding Networks.

By J. G. CUNLIFFE, M.Sc.Tech., and R. G. CUNLIFFE, M.Sc.Tech.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS *at Manchester, December 3rd*, 1912.)

(*Concluded from page* 10.)

IN order to understand the correct principles of negative feeding, it is necessary to study the effects on the flow of vagabond current of the various methods of feeding, since protection from electrolysis is the first object of the design.

With a uniformly distributed load, such as is approximately obtained with cars spaced at short intervals, the potential of the rails at any point with respect to the negative feed point is represented by a parabolic law, and if the curve of potential gradient in the rail is dropped until the two areas enclosed between it and the datum line are equal, as shown by the broken lines in fig. 5, A, the area enclosed above the rail will represent the amount of vagabond current leaving the rail, whilst the area enclosed below the rail will represent the amount of current re-entering, the curve itself then representing the absolute potential of the rail, and also the vagabond current density, at any point, the point o of intersection being the point at which the rail is at normal earth potential.

The broken lines shown in fig. 5, A, represent, neglecting any mutual effects, such curves of absolute potential for the two sub-sections of rail, the left-hand one of which is supposed to have (whether owing to greater length or to heavier loading is immaterial) a higher value of rail drop than the right-hand one. The point X, however, being common to the two sub-sections, must have a potential represented by a point on both curves which will accordingly be shifted to some positions such as those represented by the full lines, when it is evident that the two neutral points must be moved to the right and that there must be an interchange of vagabond current between the two sub-sections as shown in fig. 5, B. The higher rail drop will be reduced and the lower one increased, the tendency being to reduce their values to equality.

In considering the absolute potential conditions of any sub-section, full allowance must be made for the effects of other sections at a different absolute potential, and a sub-section may from this cause be rendered wholly negative with respect to earth, whilst safety and danger zones may be situated at totally unexpected places. Evidently then it is of importance that all sub-sections should have approximately the same value of rail drop, *i.e.*, that all negative feed points should be at the same absolute potential. This conclusion, based on the authors' researches into vagabond current phenomena described in a previous paper, also forms one of the recommendations of the recent joint Commission which will govern future German practice.

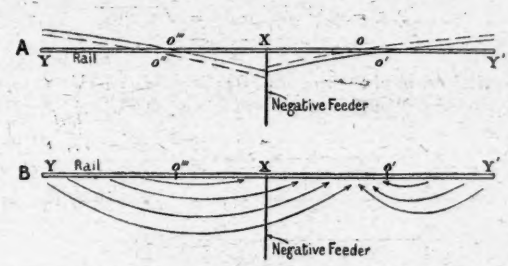
For a given rail drop the authors have previously shown the vagabond current to be proportional roughly to the square of the length of sub-section, so that it is of importance that such length should be a minimum.

The general use of negative boosters alone permits of the attainment of the two ideal conditions, viz. :—

1. Uniform absolute potential at the negative feed points, and hence no interchange of vagabond current.

2. Minimum length of sub-section, and hence minimum vagabond current.

Further, full advantage is taken of the high conductivity of the track; the rail drop is easily maintained at a low value; the pressure loss in the negative feeders is no longer subtracted from the supply pressure; great potential difference between the negative bus-bar and earth is avoided, and, finally, with heavy loading

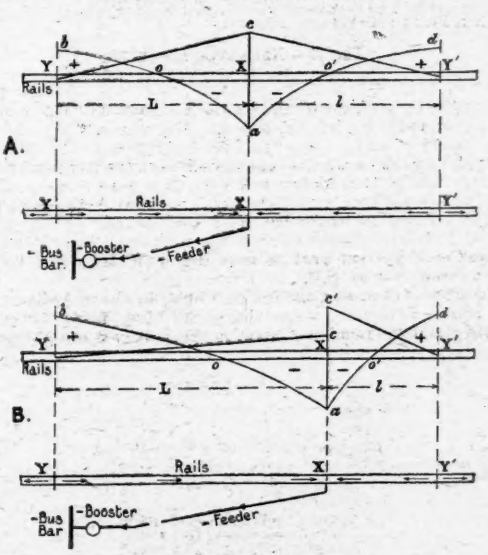


In A.—Broken line = absolute potential gradients of sections considered independently.
Full line = absolute potential gradients of sections considered jointly.

FIG. 5.—UNBALANCED SECTIONS.

a very material reduction may be obtained in the amount of return copper as compared with the amount required to obtain satisfactory conditions, even if they could possibly be obtained, without boosters. The saving in cost over the installation of additional sub-stations would be very considerable.

Economy in copper, however, must on no account be allowed to influence the amount of current to be brought back by any individual booster or the number of boosters to be employed. A maximum permissible value of rail drop must be adopted, and the amount of current to be returned must be determined solely by such rail drop considered in conjunction with the maximum



A.—UNIFORM LOADING OF SUB-SECTIONS.

X, negative feed point; Y, Y', artificial dividing points created by negative booster suction; *o*, *o'*, neutral points; *a o b*, *a o' d*, absolute potential gradients, and are identical; Y *c*, Y' *c*, loading at any point in the rails; L = *l*, length of sub-section.

B.—UNBALANCED LOADING OF SUB-SECTIONS.

L > *l*; X *c*, X *c'*, loading of sub-sections; Y *b*, Y' *d*, absolute potentials at dividing points; X *a*, common absolute potential at negative feed point.

FIG. 6.—NEGATIVE BOOSTING CONDITIONS.

intensity of loading and the specific conductivity of the track, with due allowance for increase of traffic, and it is in the determination of the booster voltage that the saving in copper may be balanced against the cost of dissipated energy.

The problem is—knowing the maximum and average intensities of loading at all points along the routes—to divide each route into negative feeding sections, each of such length that its own current flowing to its selected feed point shall split it up into two sub-sections having equal rail drop opposed in direction as shown in fig. 6, A, which illustrates the absolute potential gradients, and shows by means of arrows the direction of current flow in each of the sub-sections of rails of lengths L and *l* respectively, the con-

ditions illustrated being applicable to sub-sections of equal lengths, equally loaded. This rail drop must have the same value on all sub-sections. Fig. 6, B, illustrates the conditions to be obtained in cases of unequal intensity of loading in the two sub-sections. The lengths L and l must each be such as to give the common rail drop, with their different conditions of loading, when there will be no interchange of vagabond current. The length of each sub-section may be determined by the following considerations. Let—

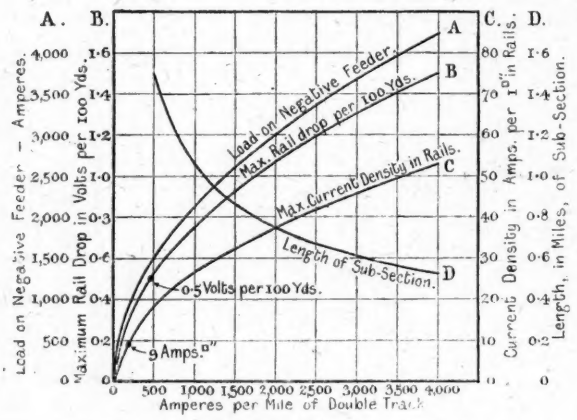
i, I = maximum intensity of loading in amperes per mile on the respective sub-sections,
R = specific resistance of track in ohms per mile,
L, l = respective lengths of sub-sections in miles,
V = maximum permissible rail drop in volts.

Then— $$V = \tfrac{1}{2}\, i \,.\, R \,.\, L^2 = \tfrac{1}{2} \,.\, I \,.\, R \,.\, l^2.$$

$$\therefore L = \sqrt{2\,V/i\,R}, \text{ and } l = \sqrt{2\,V/I\,R},$$

hence— $$L : l :: \sqrt{\tfrac{1}{i}} : \sqrt{\tfrac{1}{I}}$$

Typical values of the length L of sub-section and of the booster current, with two such sub-sections, are given in fig. 7 for various

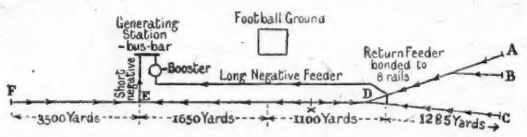

A.
B.
C.
D.
Load on Negative Feeder — Amperes.
Maximum Rail Drop in Volts per 100 Yds.
Current Density in Amps. per 1" in Rails.
Length, in Miles, of Sub-Section.
Load on Negative Feeder.
Max. Rail drop per 100 Yds.
Max Current Density in Rails.
Length of Sub-Section.
0·5 Volts per 100 Yds.
9 Amps."
Amperes per Mile of Double Track.

NOTE.—With a limit of 9 amperes per sq. in. the limit of loading is 200 amperes per mile.
Contrast above limits with the value of 4,000 amperes per mile taken from actual American practice, and upwards of 2,000 amperes per mile from British and Continental practice.

FIG. 7.—NEGATIVE BOOSTING.

intensities of loading with double track composed of 105-lb. rails of British standard section and corresponding to a rail drop of 7 volts. The values of current show that the boosters would be quite large enough to justify a separate one to each negative feeder with heavy loading, whilst, if a higher rail drop than 7 volts were allowed, or if rails of a heavier section were employed, both current and length of section would be larger, *i.e.*, the size of the boosters would be increased and their number reduced. The total length of section if the sub-sections were equally loaded would be twice the value shown in fig. 7.

In practice, however, the feeders would, in the majority of cases, be run to junctions, when the values given in fig. 7 would be doubled and the number of boosters almost halved, a slight sacrifice



A, B, C and F = boundaries of system.
D and E = negative feed points.
Line previously supplied by E only.

FIG. 8.—NEGATIVE BOOSTING. (ALL DOUBLE TRACK.)

being made in the resulting conditions to effect this end. The ideal conditions could not in any case be perfectly obtained, owing to imperfect distribution of the load, regulation of the boosters, &c., but the conditions actually attained would be greatly superior to the best that could be obtained in any other way. Many unboosted feeders could still be retained where favourably situated. Each booster should be excited from the grouped positive feeders serving the same area.

The application of the negative booster is not likely to become sufficiently general to permit of the attainment of the ideal conditions, but the latter should be kept in mind. In the most general cases a booster is required either occasionally or continuously to operate a long negative feeder in parallel with shorter ones, and gives satisfaction provided the permissible maximum rail drop is not exceeded.

An installation of this kind, designed by the authors to deal with very heavy football traffic, is illustrated in fig. 8. The heavy loading was experienced between the football ground shown and the boundary at A, B, C, and the rail drop between these points and the point D was found to be below 7 volts. The negative booster was so designed, that an artificial dividing point was created at X and moved with varying load distribution over a range such that it never reached the point D of attachment of the booster feeder. In this way the section was split up into three sub-sections, the direction of flow of current in each being indicated by the arrows. The rail drop in each sub-section was maintained below 6 volts, and although the total drop from D to E could not be reduced to zero—the ideal value—it was reduced to 2 volts as against 18 volts without the boosted feeder. This imperfect balance was due to the loading of the sub-section E F, which was beyond the control of the booster. In this way alone, by splitting up the section into sub-sections with their directions of flow mutually opposed under all conditions of loading, could the rail drop under such difficult conditions be maintained below 7 volts. The practice of connecting a group of long negative feeders to a single booster would not be possible with really heavy loading, nor would that of exciting the booster from a shorter negative feeder, and in any case with such methods the track sectionalisation is not definitely assured.

The authors have known cases where return current from a section fed by long feeders from one station entered another station by its negative feeder, flowed through its generators along its trolley wires, and through the equipments of its distant cars to re-enter the former station by a shorter negative feeder on another route. This would not occur if the potential at the negative feed points were uniform, and cannot be prevented by merely equalising the resistances of the negative feeders, although it can be minimised, since such equalising is correct for one value only of the load distribution. With boosters it is correct for all values.

It has been shown by the authors in their previous paper that one regulation alone is of any use in assisting in the prevention of electrolysis, viz., limitation of the maximum permissible rail drop, and other regulations are not merely useless, and often contradictory, but may impede progress. Thus, for instance, for a given rail drop, the potential difference between the rail and a pipe at any point is definitely fixed and is beyond control.

There are two regulations in particular which would effectually prevent the use of the ideal system of negative boosting, viz., the British limit of 9 amperes per square inch in current density in the rails, and the present Chicago limit of steepness of potential gradient in the rails, which must not exceed 1 volt per 1,000 ft. in the down-town sections and 1 volt per 700 ft. in other places. The latter is a reflection of the old French administrative rule of 1 volt per kilometre also adopted for suburban lines by the German Commission.

The maximum values of current density and rate of fall of potential in the rail with the ideal boosting conditions, British standard 105-lb. rails and 7-volt rail drop, are illustrated by the curves B and C given in fig. 7, whence it is obvious that the above values would be far too low. And yet the conditions in fig. 7 represent the maximum of safety. The limitation of current density in the rails has been adopted as the most practical way of limiting the local steepness of the potential gradient to a maximum of 0·5 volt per 100 yd., so that the two regulations are really identical in nature and are based on the fear that with a potential difference of, say, 1 volt per 100 yd., there would be a heavy flow of current in any metallic structure which happened to approach the rails at two points several hundred yards apart. It is clear however, from the curves shown in fig. 6 that these high values are obtained only in the neighbourhood of the negative feed points, where at no single point could current leave the rails, and the danger is purely imaginary.

It is widely believed that with very heavy loading the British limit of 7-volt rail drop would be prohibitive, but with negative boosting this would not be the case. The German Commission already referred to recommends a maximum value of 2·5 volts; but this is too low, as the 7-volt limit has proved to be a reasonable insurance against damage, which is all that should be expected A value recently incorporated into the City ordinances at Chicago of 12 volts maximum is considered very harsh, but the pressure drop along a pipe situated within 3 ft. of the rails may easily exceed 10 per cent. of the total rail drop, and so values greatly in excess of 7 volts are not to be encouraged.

Legislation alone cannot provide complete protection against electrolysis. It must be assisted by careful construction. Metallic structures must not approach within 3 ft. of the rails (the German Commission recommends 1 metre), and in a new construction or re-construction, care must be taken to reduce to a minimum the number of section-box frames, poles, &c., which require to be bonded to the rails as these pass down amongst the pipes beneath the footpath.

Guard wires ought to be insulated from the poles and "earthed" by means of insulated cables passing down the interior of the poles to the rails, and poles carrying gas-lamps ought to have triple insulation rather than be bonded to the track, as the latter is equivalent to bonding the pipes themselves to the track, which is bad practice.

DISCUSSION.

MR. B. WELBOURN agreed that they should endeavour to bring the point of connection of the feeder to the rails to zero potential throughout, so that the negative feeder should be used in the most economical manner; this would make electrolysis an entirely negligible quantity. Had the authors considered the raising of the pressure on the trolley wire? If the pressure were raised they would enormously decrease the expense in feeders, both positive and negative, and would also have a great many other advantages in that the number of sub-stations would be reduced, and so on There was no inherent difficulty in making trolley wires perfectly

safe, even if an auxiliary suspension had to be employed to prevent a broken wire from falling into the street. It was for the designer of tramway equipment to say what the limit was that tramway motors and controllers could be arranged for.

MR. S. L. PEARCE said it would have been very interesting if they could have had some concrete figures dealing with the Manchester tramway system, showing how the increased service—the proportion of the larger to the smaller cars—had affected the question of power. A striking increase of power had been required. The authors stated that "in view of the strict limitation of the line pressure the governing factor in the feeder designs must, at some stage in the development, change from overheating to pressure drop, and that boosting must ultimately be resorted to." That was a rather sweeping statement, and he took it that it entirely referred to D.C. 600-volt systems; it would not be correct in the case of mixed systems. The authors referred to the reluctance of engineers to employ feeders much larger than 1 sq. in. in cross-section. He recently had occasion to look into that, and had come to the conclusion that where it was necessary to use a total of 1 sq. in., it was better to use two halves rather than 1 in.; it enabled the current density to be pushed up much higher with two halves than by using one 1 in., and even after allowing for the slightly increased cost of the cable, and so forth, it was still a commercial proposition. The authors stated that the amounts of current returning by the respective feeders, if of the same size, would be almost inversely proportional to their length, and they went on to say that the distribution of the return current amongst the feeders was governed by the nature of the load distribution. His experience was that the low-resistance rails would to a very great extent swamp the load distribution, and that by employing resistances in the short negative returns to a limited extent, the current did return by the respective negative feeders in inverse proportion to their lengths. If the resistance of a short negative was increased the effect was the same as reducing the resistance of a longer one, and the balance point was moved only in one direction. Frequently it would be found that it was far better to cut the bonds and allow the separate negative feeders to bring back their own currents respectively. He entirely agreed with the statement that "for a given length of track, with increasing loading, the maximum permissible rail drop is ultimately attained, when copper must be provided to carry any additional current, and as this copper is operated at a very low current density, its use is very uneconomical"; it was quite a mistake to attempt to put copper in parallel with the rails; if there was any copper to spare it should go into the negative feeders. The authors stated that by the use of negative boosters the flow of current in the rails might be controlled in a manner which was almost ideal; but was it commercial? There was a very great difference between necessary conditions and ideal conditions. There was no electrolysis in Manchester. In many cases a resistance in short negatives was used to secure all that was really necessary or desirable. The strongest point for the use of negative boosters, apart from the ease of load distribution, was the fact that pressure loss in the negative feeders was no longer subtracted from the negative section. Fig. 7 would be of very great value when tackling other problems. No one would pretend for a moment that it was possible to install the negative booster for such low capital expenditure as resistances. The authors referred to the necessity of having treble insulation when tramway standards carried gas lamps; obviously the correct thing was to move the gas lamps.

MR. J. S. PECK said that some of his friends in America had never heard of negative boosters, and did not know what they were at all, evidently owing to their having no laws in America until recently regarding the allowable drop in rails. There was very little attention given to the matter as long as the current got back somehow in the cheapest and easiest way; but they would suffer for that in the long run. The reason why electrolysis was coming more into effect in some cities, and of the increasing advance with feeders, both positive and negative, as had been pointed out by the authors, was the general tendency to force up the schedule speed and the general increase in car weight.

MR. H. A. RATCLIFF thought that the negative resistance was not always understood. As an energy-converting device, the resistance had precisely 100 per cent. efficiency, and a booster never approached that efficiency. The resistance had practically no maintenance charges or running cost, and no capital cost; it would not fulfil the ideal conditions, but it would fulfil the necessary conditions.

MR. E. M. HOLLINGSWORTH said he tried running negative feeders without boosting some years ago, but they were absolutely useless. Later on, owing to the increased service, it was found that the drop was excessive, so negative boosters were put in, though they could not possibly get the ideal conditions, for the reason that Mr. Pearce had pointed out. At St. Helens they had had one or two bad cases, though, perhaps, they were rather peculiarly placed on account of chemical works at that place. Two fires had occurred owing to guard wires being pulled down and the water pipes being in contact with the gas service, which was, perhaps, 150 yards away; and on another occasion a subway caught fire, due to an electric telephone cable which was carried down one of the standards. The guard wire was again the cause of the trouble, and he agreed with the authors' remarks that guard wires should be earth-connected by means of insulated cables; this also applied to gas lamps. He had tried connecting the lead-covered cables for a tramway system to the rails, and found that they were getting electrolysis, so he disconnected them, and since that time he had not experienced any trouble.

MR. C. C. ATCHISON said as time went on schedules were altered, conditions of working were different, and the negative feeders, which were big enough to suit the original conditions, were at the present moment almost useless. Many of the large undertakings might have been able to straighten them out, but difficulties arose in small undertakings. He did not think radiating sub-feeders were as good as separate feeders in a busy area. If sub-feeders were supplied by one big feeder, and the big feeder was put in on a busy route, every driver on that route would be trying to start at the same time, and it was almost impossible to keep the breakers in. He had a very disrespectful opinion of guard wires as a whole. He did not approve of insulating guard wires and trying to keep the poles and pipes insulated and separate from the rails, because, after all, one wanted to protect the pipes. In towns where the municipality worked the tramways, it should be an instruction to any department that was laying pipes that they should be kept at such a distance as to be safe. Mr. Pearce had pointed out that two 0·5 cables were better than one of 1 sq. in., and from past experience he endorsed the statement entirely.

MR. A. G. COOPER said they ought to put down heavier rails so as to minimise the rail drop, because the extra price for the rails would be cheaper than putting down copper feeders. He quite agreed that it was much better to put down two small feeders than one large one on account of the current density.

MR. R. ROWLANDS referred to fig. 8. He had arranged to put all the feeders through the booster, and in the event of the breakers coming out, if only one feeder was coupled up, there would still be the load to be dealt with on the remaining section, as in this case there were two separate positive feeders. He had arranged for an electrical control governor to be placed on the end of the shaft, which cut out the booster before it reached a dangerous speed. They had in this case run two negative 0·8 in. feeders instead of one 1·6 in. With regard to the point of connection, fig. 8, he thought that the connection at "D" was not at the right point.

MR. C. G. L. PREECE believed Glasgow was the first to adopt the negative booster, and had paid a great deal of attention to limiting the rail drop. At one time a very large system of potential wires was used in its system of negative feeders, and the function of these was similar to what the authors described in the paper. As far as he remembered, the positions of the negative feeders were fixed from results obtained from the system of potential wires, and on a visit to a sub-station, he was shown the drop of a great number of sub-sections in the city, and noticed that it did not exceed 2 volts in any of those sections.

DR. E. ROSENBERG said he could not follow why resistance had 100 per cent. efficiency and the booster only 80 per cent., for after all if they wanted to generate heat, everything had 100 per cent. efficiency. The resistance drop was a dead loss, but if the dead loss was only for a few hours during the whole year the yearly annual efficiency might, of course, be better than that of a machine with 20 per cent. less efficiency.

MR. H. E. YERBURY (in a communication) said that the deplorable state of things formerly existing in Chicago and other American cities could not have existed under B. of T. rules and regulations, and he saw no reason to fear any trouble now that overloading conditions prevailed in many of our large towns. The Sheffield Corporation Act of 1901 had a protective provision inserted by the Sheffield Gas Co., relative to possible electrolytic injury or damage to mains, pipes, &c., and although the loading and output in units had been more than trebled since that year, it had been demonstrated to the satisfaction of the company that no trouble had taken place, and that they were still able to work within the B. of T. limits. With respect to positive feeding, he thought the system of feeding with graded distributors was preferable in point of efficiency and economy to the Manchester system, as shown in fig. 2. He saw nothing new in what was called the authors' design (fig. 8). The correct principles of negative boosters and returns were dealt with by himself in an informal paper read before the Leeds Local Section of the I.E.E. on April 13th, 1905, which was published in the technical journals. With regard to present legislation, taken as a whole the results were satisfactory to all concerned. Still, he thought the limit of 9 amperes per sq. in. for the current density in the rails could be exceeded under certain conditions, without harmful results.

The AUTHORS, in reply, said that boosters were not recommended for cases where other and cheaper methods were available, but there were conditions of loading where only boosters would enable the requirements to be fulfilled. Where possible with economy, the control of return circuits by the balancing of feeders was advisable, but was limited, with extra heavy loading, by the loss of pressure in the return feeders. This loss was not obtained if negative boosters were used. With respect to Mr. Pearce's remarks *re* the use of two ½ sq. in. feeders in place of a 1 sq. in. feeder, they referred more particularly to heavier feeders than those, and advised multiple feeders on grounds of greater facility in handling and laying, greater reliability in operation, and greater factor of safety, with the advantage that breakdown of one component did not cut out the whole feeder. There were objections to the use of a large number of boosters in a single station, and the compound feeder was put forward to minimise the number of boosters. They again emphasised the importance of keeping pipes and metal work at least 3 ft. distant from the rails. The Chicago rails were bonded at all possible places to the elevated railway structure, and the result had not been such as to support the principle of such bonding. In addition the pipes were bonded to the rail at all parts of the system; yet the resulting damage from electrolysis was notorious. It was of greater importance to know what currents the negative feeders were carrying than was the case with positive feeders. The suggestion to use heavier rails so as to utilise steel in place of copper, presupposed the advisability of employing bare conductors

in parallel with the rail, which they had stated to be inadvisable on account of the low efficiency and heavy expense. The results indicated the correctness of the design in fig. 8.

Earthed v. Unearthed Neutrals on Alternating-Current Systems.

[The paper on this subject, by MR. J. S. PECK, of which an abstract was given in our issue of December 6th, 1912, was read before the NEWCASTLE LOCAL SECTION of the INSTITUTION OF ELECTRICAL ENGINEERS on December 9th, 1912.]

MR. W. C. MOUNTAIN, chairman, in opening the discussion, said for private installation work he favoured unearthed neutrals, and from a colliery engineer's point of view he thought that this system was advisable. The confusion which would result from a sudden cutting-off of all power and light would be far worse than an earth on an insulated system. He had always hesitated about putting automatic features underground, and preferred a leakage indicator.

MR. C. VERNIER (N.E.S. Co.) said that he was a firm believer in earthing everywhere, without exception. A cable generally broke down to earth first, and it was advisable to isolate it as quickly as possible, and before it had time to develop a fault to earth. On an insulated system some time was required to locate the fault, and while this was being done there was always the risk of another fault occurring on another phase. While small systems might be left unearthed, at the discretion of the engineer, he considered that those systems which were at present running satisfactorily without earthing would eventually find it advantageous to earth when they reached a certain size. Telephone disturbances were almost entirely due to electrostatic induction, and with one phase earthed the whole electrostatic balance of the system was upset. In his opinion the neutral should be earthed for distribution circuits, and he attributed the freedom from serious accidents in this country to the usual practice of earthing in such cases. The reduced cost of insulation by earthing the neutral was not worth considering for voltages up to 50,000, but above this it might be worth while, especially where corona effects were present to take care of pressure rises. He strongly disagreed with the suggestion that in order to maintain continuity of supply, high-tension lines should not necessarily be cut off in the event of a fault, as this was simply balancing the cost of a duplicate supply against the danger to life. Whatever views might be held in other countries, this was considered most important in this one, and there was already quite sufficient prejudice against overhead work without introducing any doubts regarding safety. "Split-conductor" protection, which was the latest development in protective devices, promised to be of great importance, as it operated in the most positive manner on the breakage of a conductor wire.

PROF. W. M. THORNTON (Armstrong College) mentioned that in every electrical circuit the resultant current was zero, and he could not understand why it should be considered necessary to raise this point so often. Referring to fig. 1, he asked what was the smallest earth current at which the system would operate.

MR. HUNTER said that it could be made to operate with 1 per cent. of the line current, but a delicate relay was necessary.

PROF. THORNTON (continuing) remarked that the opinion was held, especially amongst mining men, that the risk of breakdown was increased by earthing the neutral, and it was interesting to note that the author's opinion was to the contrary. Regarding the presence of surges following arcing between phases, he put forward the theory that these were due to the condenser action of the incandescent metallic vapour in conjunction with the reactance of the line, thus forming a circuit which would resonate with great violence. Instead of using resistances for earthing the neutral, he suggested the use of choke coils, on the assumption that the cost of these would not prove prohibitive.

MR. P. V. HUNTER (Merz & McLellan) said that he had had experience of unearthed neutrals in the early days of the Durham Collieries system, and had found that when one fault occurred other faults occurred simultaneously at one or more parts of the system, probably due to the free energy liberated when one phase went to earth. He had known cases where high voltages had occurred on low-voltage systems having insulated neutrals; in one case a 600-volt system fed through a transformer from 6,000 volts, sparked through a paper disk which would stand at least 1,200 volts. With regard to "potential front," he had come across one case where sparking took place over a 10-in. gap on a boosting transformer which normally could not have more than 2,000 volts across its terminals. Such sparking could only be explained by "potential front" when switching the cable and booster together.

MR. F. O. HUNT referred to a device brought out by Mr. M. B. Field, which worked on the same principle as that shown in fig. 1, but in that case the magnetic fields were balanced and not the currents. He thought that a choking coil in the earth connection might form a resonating circuit with very low resistance, in conjunction with the capacity of the cable network.

Norway's Electrical Imports.—According to the latest statistics published, Norway was an importer in 1911 of cable and insulated wire to the value of 1,919,000 kr.; of accumulators and accessories to 79,000 kr.; of electric apparatus, including telephones and telegraphic instruments to 363,000 kr.; of glow lamps, to 498,000 kr.; and arc lamps, 10,000 kr. About three-fourths of these goods were supplied by Germany.—*Elek. Zeitschrift.*

THE JOHANNESBURG TURBINE CONTRACT.

JUDGMENT was given by Mr. Justice Ward on December 3rd in the Witwatersrand Division of the Supreme Court, in the action for libel brought by Mr. John Taylor against the *Rand Daily Mail*, Ltd., and his decision was published in the Johannesburg newspapers.

His Lordship said: The plaintiff in this case is a solicitor, and has been since 1907 the town clerk of Johannesburg. Among other enterprises carried on by the Municipality of Johannesburg is the manufacture of electricity for the purpose of running its own tramcars, and of supplying the inhabitants with light and power. The first plant contracted for by the Council consisted of certain gas engines, which proved an absolute failure, and in April, 1907, it became necessary to install a new plant as quickly as possible. The Council then had an advisory board of expert engineers in connection with the gas engines, and, under the advice of this board, a steam plant was purchased from Messrs. Reunert & Lenz. Rapidity of delivery was essential, and the contractors tendered to deliver in eight weeks, as against the next tender of 13 weeks. In 1907 another set was purchased, and here again rapidity of delivery was essential, and the order was given to Messrs. Reunert & Lenz, who contracted to deliver in 16 weeks, as against the next tender of 36 weeks. A third order for 1,000-KW. and 500-KW. sets was considered in February, 1908; quick delivery was again an essential, and the order was again given to Messrs. Reunert & Lenz, who undertook delivery two months earlier than next tender. A fourth order was also given to Messrs. Reunert & Lenz for a 1,000-KW. set. There was no question of rapid delivery in this case. Tenders were called for a 1,000-KW. set, and the choice lay between the plant accepted for £12,695, or a 1,800-KW. Parsons turbine set for £13,450, both of which were on exhibition and ready for delivery. The latter set was recommended by the manager, as also by the Tramway Committee of the Council. The Council, however, accepted the tender of Messrs. Reunert & Lenz. The defendants, in their issue of August 4th, 1908, commended the Council for its action, on the ground that direct current turbines were still experimental so far as Johannesburg was concerned, and that the Council was consequently taking the safer course. In the case of the second set, a board of technical advisers recommended a Parsons turbine. But the Council rejected the advice, and ordered a set from Messrs. Reunert & Lenz on account of the rapidity of delivery. The plaintiff had nothing to do with any of these purchases. He was the town clerk, but as I understand the matter was decided by the Council independently of him, and in the case of the fourth order he was away in England. An engineer named Thomas was at the time these orders were placed the manager of the electrical department. In September, 1911, the Council decided to order further plant and to call for tenders for that purpose. Prof. Dobson, the manager of the electrical department, was entrusted with the duty of making out the specifications and conditions of tender. As it was desired to have the plant ready for the Christmas load of 1912, it was decided to make the period for delivery 45 weeks.

On January 31st, 1912, Prof. Dobson, the Council's manager, reported on the various tenders received, and recommended the acceptance of the tender of Messrs. Reunert & Lenz. This was reported on by the Tramway Committee on February 2nd, 1912, and sent forward to the Council. On February 13th, 1912, a letter was sent to the Council by the Chamber of Commerce, criticising Dobson's report. The matter was referred back to the Tramway Committee, with a recommendation to have the tenders reported on by a Government electrical engineer or three experts appointed by the Council. On March 11th, 1912, the Tramway Committee met the Chamber of Commerce representatives, who were, in fact, the unsuccessful tenderers, as their representatives and the representative of the successful tenderer. Naturally, therefore, the representatives were not quite unanimous in their views. Certain letters and criticisms were then sent to the Council by these representatives. T. Dobson, the general manager, made a report in reply. On March 26th, 1912, Messrs. Rider and Tippett, the former an eminent electrical and mechanical engineer, and the latter a civil engineer who holds the position of chief engineer of the South African Railways, and has had considerable experience in contracts, were appointed as a board to report as to which was the most advantageous tender for the Council to accept, the board bearing in mind the condition of affairs at the power station; and, further, Prof. Dobson's three reports referred to in the criticisms of the Chamber of Commerce, and on those criticisms, Prof. Dobson's reply to these criticisms; to report generally on any matter at the power station which, in the opinion of the board, affected the questions submitted to it. On April 17th, 1912, Messrs. Rider and Tippett reported at considerable length. On April 19th, 1912, the Tramway Committee instructed the town clerk to report upon the engineers' report. On April 22nd, 1912, the plaintiff reported at great length on the situation and on the engineers' (*i.e.*, Messrs. Rider and Tippett's) report. He had the assistance of two technical advisers on the town staff. Prof. Dobson was at this time ill. The plaintiff says that if this had not been so, Prof. Dobson would have been asked to report instead of himself. The engineers recommended the acceptance of the tender of Messrs. Sykes & Co. The plaintiff's report was considered by the Tramway Committee, who recommended the acceptance of the tender of Messrs. Reunert & Lenz, recommended by Prof. Dobson. This recommendation was accepted by the Council on April 23rd, 1912. On April 25th, 1912, a motion was brought before the Council to rescind this resolution, but it was lost. A great deal of excitement and comment was caused in the town, and the action of the Town Council was freely discussed. On

June 21st, 1912, the defendants published in their issue of that date an article taken from the ELECTRICAL REVIEW, London, which is the article complained of in this action.

The plaintiff has set forth certain passages in his declaration to which he attaches certain innuendoes, and the Court is asked to hold that the passages bear the meaning alleged, taking into consideration the whole tenour of the article and the surrounding circumstances. The surrounding circumstances relied upon are that charges of bribery and corruption were being freely made in speeches by town councillors, which were published in the defendants' paper. Thus on June 14th, 1912, a Mr. Bernberg, who appears to have at that time been the general secretary of the South African Labour Party, is reported to have said, at a meeting of a branch of that party for the purpose of expelling a Mr. Jackson from the party for his action in connection with "the turbine trouble," which I presume refers to the contract in question: "If they had any Labour principles at all, those principles were that they should be solid on all matters in which there was a reasonable suspicion of bribery and corruption." On June 27th, 1912, a leading article was published in the defendants' paper in which it was stated: "The meetings of the Council degenerate into scenes of turbulence, in which charges of jobbery and graft are hurled with distressing frequency," and suggested that new men must be sent to the Council able to transact business with dignity and in a manner not calculated to arouse suspicion. On March 24th, 1912, a Mr. Mulvey, is reported in defendants' issue of that date to have said in the Council: "He had heard of graft in America, but he thought that Johannesburg could give the average American city points." Then, after referring to Messrs. Rider and Tippett, he continues: "The time has come for a Government inquiry upon oath into the affairs of the Johannesburg Town Council." On July 2nd, 1912, a Mr. Benson, another councillor, is reported to have said: "He had never accused Prof. Dobson of taking bribes;" then, after quoting from the ELECTRICAL REVIEW (*i.e.*, the article complained of), to have added that his position was supported by that article. He had submitted the urgency report to judicial authorities, and they had one and all asked, Who's getting something out of it? On June 26th, 1912, Mr. Mulvey, again moved that, in view of the serious allegations contained in the ELECTRICAL REVIEW on May 30th *re* the management of the town of Johannesburg's business affairs and other allegations made from time to time, "we approach the Government for an independent inquiry." I have set forth these circumstances at this juncture, as it is perhaps more convenient to have collected before one the circumstances on which the plaintiff relies as proving his innuendo before dealing with the actual words. These may be divided into three classes:—(1) The defendants' own attitude as shown by the article calling attention to the matter complained of, and to the reply to the letter of demand. (2) The fact that prior to the publication of the article charges were made in public in connection with this particular contract that there was corruption somewhere. (3) The fact that the same charges were made after the publication of the article, and that speakers referred to the article as containing grave charges.

That the article contained grave charges of mismanagement was stated by Mr. Mulvey. Mr. Benson's position, which he says was justified by the article, it is rather difficult to find, but I do not see any charge of bribery made except as a deduction by certain judicial authorities from the urgency report. It was contended that the defendants are bound by a meaning attached to the words in speeches of third parties, seeing that they have reported such speeches without contradiction. But in the case of a newspaper it cannot be said that the editor is cognisant of the meaning attached to words used, although there may be a report of a speech in his paper which gives that meaning to them. This point, and the fact that one or two individuals attach a certain meaning to the words, may be considered by the Court sitting as a jury, but the jury are entitled to reject such meaning. Coming now to the article complained of, this starts by giving a history of the first four contracts, which is fairly accurate until we come to the summing-up of the situation, when we read: "Thus we see four contracts given away to one firm at prices far in excess of what need have been paid and in face of the best engineering advice procurable, which advice was not offered in an officious manner, but was solicited, and we presume paid for by this Council." This statement is not true. Only one of the contracts was given contrary to the technical advice outside the municipality's own advisers. With regard to three of the contracts, time of delivery was the most important factor. In one case, the Council refused to make an experiment by using turbines, and, in the other, they refrained from taking an 1,800-KW. set which was ready for delivery in favour of a 1,000-KW. set which was also ready. Tenders had been called for a 1,000-KW. set. The article goes on then to give an account, not inaccurate, of the history of the last tender, with some account of the board's report (*i.e.*, of the report of Messrs. Rider and Tippett). Then it goes on: "The town clerk of Johannesburg, to whom, as the executive head of the Corporation staff, the report was sent, took it upon himself to criticise it." This is not true. The plaintiff was instructed by his Committee to make a report upon the report. It is said that this does not mean criticising it, and consequently he did take it upon himself to criticise it. He was asked to make his report, and I do not see how he was to do so without criticising the report. It was his duty to give his views; his views may or may not have been inept, but it was his duty to give them. Messrs. Rider and Tippett considered that their report, being technical, would not be understood by the Council, and did not think it should be criticised; they would never have made it if they had thought it was to be criticised, so they say. And the attitude of the article is that Messrs. Rider and Tippett's report was from the nature of the case beyond criticism, especially by laymen. But after a careful perusal of both the report and the criticism of the plaintiff in so far as the business portion of it is concerned apart from the technical portion, the observations of the plaintiff appear to me to have been quite called for and just. He is pointing out to his Committee the practice laid down previously as he was obliged to do; the question, for instance, of having a separate tender for foundations or erecting them departmentally might make a vital difference in the Council's view. There is no doubt that the correct course then was to call the board's attention to the Council's attitude on these points, so that the Council could get the benefit of its advice from that point of view. With regard to the technical point, it is impossible to judge of the merits, but, although differences may be only a matter of opinion, the Council certainly should have borne in mind that they had eminent independent technical advice on one side as opposed to that of their servants on the other. They may have paid attention to this for all I know; whether they did or not I cannot see that the plaintiff was in any way to blame for putting before them the views of their technical advisers, seeing that he was asked to report. To proceed with the article: "His criticism extends over 35 pages of typewritten matter, and for a thoroughly bumptious, consequential and extravagantly-absurd concoction, we have never seen its equal." This is said to be libellous, and the innuendo is that either the plaintiff is incompetent as a town clerk, or that he was dishonest in his criticism of the report. But I do not think the words can be made to bear that construction. The writer is entitled to express his opinion of the merits of the town clerk's report as a literary or technical production provided he does not impute dishonest or disgraceful motives. The view of the writer of the article is clearly largely influenced by the fact that a layman was exhibiting the audacity to criticise a technical report. But that does not affect the question as to whether the words are defamatory. In my opinion, they do not, as they stand, bear out the innuendo alleged. The article proceeds with the history of the breaking down of a certain turbine. The plaintiff called attention to the fact that the board had concluded, from the papers before them, that Messrs. Reunert & Lenz were entirely responsible for the breakdown, and remarks that they are not in a postion to give a judgment on the point, inasmuch as Messrs. Reunert & Lenz's answer was not before them. It is not necessary to decide whether he was right or wrong in this; the view, from a legal standpoint, is not without merits, though a board of experienced technical experts doubtless thought they had sufficient to form a judgment on the matter. The article says:—"We hope these words, which we presume, express the considered opinion of the town clerk, as the legal adviser of the Corporation, will be duly noted by the manufacturers." I have been unable to find what is meant by this; no explanation was offered in argument by either side; but I take it the writer is commending to the notice of the manufacturers the fact that the town clerk's view is that a Belliss turbine should not be condemned as defective mechanically until it is established that the accident to the No. 2 turbine was caused by mechanical defects. This does not appear to me to be defamatory.

The article proceeds:—"Next we find this choplogic genius arguing over the meaning of the word dismantled. They saw No. 2 turbine dismantled, said Messrs. Rider and Tippett. The town clerk pretends to think that this might lead people to suppose that it was being taken down as useless and condemn the board's report on this account." It is said the sting in this is in the use of the word "pretends." I do not think that this is defamatory. The words "pretends to think" quite clearly are capable of meaning that the defendant falsely states that he thinks, whereas he does not, which would certainly be defamatory and bear out the innuendo that he was dishonest in his criticism. But the expression also means "professes to think," which does not mean he puts in a claim falsely. The expression is a rhetorical one, which is used to express strongly the view of the writer that an expression which has been criticised cannot bear the meaning attached to it by the critic. In my opinion, that is all that the expression means here, and is not, in my opinion, speaking as a juryman, defamatory. The writer does not think that anyone can take the view that the words used in the report by the board were open to misconstruction. For my part, I must say that I think the words were quite capable of bearing the construction to a lay mind that Mr. Taylor says they bore to more than one town councillor. The expression, "We saw dismantled," is certainly open to the construction, "We saw in a dismantled state." The report is not condemned on this account, but the expression is explained for the benefit of the readers who Mr. Rider said he never expected would understand his report. But though I am satisfied there was no pretence at all in the town clerk elucidating the expression by a reference to the facts—I do not think this passage defamatory. The expression is purely rhetorical, and does not, in my opinion, convey any imputation against the plaintiff's character. The next passage set forth in the declaration, and which follows immediately in the article is this:—"He then goes on to prate of professional conduct and the fact that Prof. Dobson's reputation was in their hands. Now the board treated him with quite as much consideration as he deserved, and quite as much, to judge from our prefatory remarks on the contracts, as he was accustomed to obtain." This passage contains a very serious misstatement of fact—in that it suggests Prof. Dobson was connected with the former contracts, when, as a fact, he was not in the employ of the Council at that time—but the whole passage appears to be more an attack on Prof. Dobson than on the plaintiff; but the sentence clearly shows that the writer was not careful to inquire who was connected with the other contracts, and it may be of importance, when one comes to examine the meaning of the text of the articles as a whole.

(To be concluded.)

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

MEXICO.—With reference to a notice which appeared in these columns recently regarding proposed increases in the rates of duty on imported goods levied under the Mexican Customs Tariff, the Board of Trade have received telegraphic information from the British Legation in Mexico to the effect that the previous Bill has not been passed, and that the Mexican Government intend to present to Congress a modified project providing for the increase of the Customs duties by 7 per cent. in addition to the increase of 5 per cent. which was previously proposed. If Congress does not pass the new Bill during the present session a special session will be called to deal with the matter.

ROUMANIA.—A considerable amount of trade with Roumania is carried on *via* certain European ports which possess what are known as "free zones"—*i.e.*, sections of the open port which are in the nature of bonded districts. When goods are transhipped at these ports for final destination in Roumania, it is often difficult to determine the actual country in which they originated, and as the Roumanian tariff is divided into two parts, one the General (higher) tariff, applicable to countries not entitled to most favoured nation treatment, and the other, the Conventional (lower) tariff, applicable to countries having treaty arrangements with Roumania, the duties to be levied on the goods are open to doubt. The Customs Authorities have, therefore, decided that goods arriving in Roumania from the undermentioned European ports possessing a "free zone" cannot be assessed for duty under the Roumanian "Conventional" Tariff unless they are accompanied by a certificate of origin which specifies the country of production or manufacture of the goods :—

Austria-Hungary.—Trieste and Fiume.
Italy.—Genoa, Leghorn, Oneglia and Venice.
Germany.—Hamburg, Cuxhaven, Bremerhaven, Geestemünde, Emden, Neufahrwasser, Stettin, Altona, Bremen and Brake.
France.—Marseilles.
Denmark.—Copenhagen.

From February 1st, 1913, all goods arriving in Roumania from the foregoing ports, unaccompanied by a certificate of origin, will be assessed for duty under the Roumanian "General" Tariff.

SWEDEN.—The British Consul at Stockholm, in a recent report, states that he again wishes to point out that if imported goods bear the name of a place, property, industrial establishment or tradesman in Sweden, or any marking in the Swedish language to explain the nature of the goods—even consisting only of a single word—they must also bear the word "import" or the name and domicile of the foreign manufacturer, applied in a distinct and conspicuous manner, so that removal or effacement cannot be effected easily or without injury to the goods. Goods not so marked are liable to confiscation. The Customs Authorities will not permit goods to be marked *subsequent* to confiscation, and it is therefore impossible to get them restored once they have been condemned by the Court. The Consul adds that goods which are packed and imported in bulk, but can be sold singly, must themselves be properly marked so as to show their foreign origin ; the fact that such marking may have been applied to the packing or covering in which the goods are imported will not of itself constitute a sufficient compliance with the Swedish regulations.

AUSTRALIA.—The Commonwealth Customs Authorities have issued the following decisions as to the duties to be levied on certain electrical and similar goods on importation ; the rates of duty quoted are in all cases the preferential duties applicable to goods of British origin accompanied by a certificate to that effect in the proper form :—

Thermal electric baths :	
Cabinet	30 % ad val.
Electric heating portion	10 „
Fittings for electric conduit :	
Plain tee and elbow inspection pieces	10 „

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this ournal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

29,522. "Electric machines." Soc. Dite S.T.A.R. (Systeme de Traction Auto-Regulateur.) (Convention date, December 21st, 1911, France.) December 23rd. (Complete.)

29,533. "Frosting or obscuring glass globes, chimneys, electric lamps and the like for use with gas, oil and electric light." W. Sharp. December 23rd.

29,536. "Telegraphy and telephony." H. W. Sullivan. December 23rd.

29,566. "Method of adjusting electric meters." O. T. Blathy. (Convention date, June 20th, 1912, Hungary.) December 23rd. (Complete.)

29,569. "Electric heaters." L. H. Mayer. December 23rd. (Complete.)

29,579. "Telephone systems and the registration of calls and messages therein." H. Hawthorn and H. T. McNeale. December 23rd.

29,581. "Magneto-electro machines for combined ignition and illuminating purposes." F. R. Simms. December 23rd.

29,612. "Sanitary attachments for telephone apparatus." M. J. de Zoltynsky. December 23rd. (Complete.)

29,620. "Electric ignition generators." B. Lawrence. December 23rd.

29,636. "Driving vehicles by means of internal-combustion engines combined with dynamos, accumulators and motors." H. Pieper. (Divided Application on 3,281/12, February 9th. Convention date, February 20th, 1911, Germany.) December 24th. (Complete.)

29,639. "Manufacture of tungsten." C. Gladitz. (Divided Application on 12,244/12, May 23rd.) December 24th.

29,698. "Adjustable electric lamps." H. Fairbrother. (Vesta Accumulator Co., United States.) December 24th.

29,719. "Impulse sending mechanism." Western Electric Co., Ltd. (Western Electric Co., Belgium.) December 24th.

29,721. "Telephone systems having automatic switching apparatus connected over junction lines with a manual exchange." Siemens Bros. & Co., Ltd., and T. Pettigrew. December 24th. (Complete.)

29,736. "Fittings for electric incandescent lamps." T. B. Pickard. December 24th. (Complete.)

29,750. "Element for electrical heating." H. J. Dowsing and D. Huntley. December 24th.

29,759. "Time meter for gas and electric fires and lights." C. B. Tully. December 24th.

29,763. "Electric cooking and heating appliances." A. H. Railing and C. C. Garrard. December 27th.

29,774. "Electric cable-connecting boxes or apparatus." British Insulated and Helsby Cables, Ltd., and R. W. Blades. December 27th.

29,778. "Electric locks for lift and hoist gates." C. G. Major and Smith, Major & Stevens, Ltd. December 27th.

29,781. "Method of and apparatus for use in and in connection with electro-plating." E. E. L. Grundy and G. P. M. Lee. December 27th.

29,783. "Electricity multicore cable dividing boxes or apparatus." British Insulated and Helsby Cables, Ltd., and R. W. Blades. December 27th.

29,809. "Electric terminals." H. Lucas and W. H. Edwards. December 27th.

29,826. "Apparatus for electro-osmose." Ges. fur Elektro-Osmose M.B.H and H. Illig. (Addition to 725, 1912.) December 27th. (Complete.)

29,832. "Means for electrical alarm signalling in connection with steam or other engines and machinery." T. H. Hill. December 27th.

29,842. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) December 27th.

29,846. "Manufacture of dry cells." J. A. E. Achenbach. December 27th. (Complete.)

29,847. "Primary galvanic cells." J. A. E. Achenbach. December 27th. (Complete.)

29,848. "Manufacture of negative electrodes or secondary alkaline cells." H. P. K, L. Porske and J. A. E. Achenbach. December 27th. (Complete.)

29,859. "Supports for desk telephonic instruments." D. D. Cushman and David Moseley & Sons, Ltd. December 28th.

29,863. "Construction of electro-magnets." Steel, Peech & Tozer, Ltd. and H. E. Bowen. December 28th.

29,874. "Device for recording telephone calls in connection with the measured rate system of post office telephones." G. H. Parry. December 28th.

29,879. "Detachable electric immersion heater." G. H. Ide. December 28th.

29,881. "Electric advertising devices or signs." E. H. Bickley. December 28th. (Complete.)

29,905. "Automatic instantaneous switches for alternating and direct-current circuits." A. M. Taylor. (Addition to 7,141, 1910.) December 30th.

29,956. "Line protective devices or the like." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co., United States.) December 30th.

29,986. "Magneto generators." L. Johnson, J. T. Roberts, and B. Lawrence. December 30th.

29,999. "Method of and apparatus for electric welding." R. Haddan. (Cleveland Welding and Manufacturing Co., United States.) (Divided application on 17,749, 1912, July 31st.) December 30th. (Complete.)

30,024. "Electric switches and the conductor switches thereto." H. C. Sheldon. (Sashsiche Gruppenwechselschalter G.m.h H., Germany.) (Divided application on 3,590, 1912, February 13th.) December 31st. (Complete.)

30,059. "Electrically-operated mechanism." F. H. Nicholson. (Convention date, March 8th, 1912, United States.) December 31st. (Complete.)

30,060. "Electric switches." P. S. Turner and A. E. Roberts. December 31st.

30,103. "Dynamo-electric machines." H. A. Mavor and Mavor & Coulson, Ltd. December 31st.

30,105. "Electric regulating devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) December 31st.

30,106. "Systems of electric distribution." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) December 31st.

30,107. "Regulation of dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) December 31st.

30,111. "Ear and mouthpiece protectors for telephones." E. Dannenberg. December 31st. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford ; price, post free, 9d. (in stamps).

1911.

Electric Furnaces. N. Testrup and T. Rigby. 19,923. September 7th.

Type-Printing Electric Telegraph Systems. W. S. Steljes. 20,106. September 11th.

Typographic and Like Receiving Instruments for Electric Telegraph Systems. W. S. Steljes. 20,107. September 11th.

Electrically-operated Time Indicating Devices. L. J. Aron and C. E. Harrison. 20,268. September 12th.

Apparatus for Automatically Operating Gas or Electric Lamps. C. R. Oliver. 23,782. October 27th. (April 25th, 1912.)

Automatic Electric Fire-Extinguishers. S. B. Priest. 27,163. December 4th.

Means for, and Methods of, Clearing Faults on Alternating-current Systems. A. M. Taylor. 27,560. December 8th. (Cognate applications, Nos. 11,560 and 12,509 of 1912.)

Devices for Regulating the Speed of Machinery. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 27,788. December 8th.

Prepayment Attachments for Electric Current Limiting Devices. H. B. E. Nordfeldt. 27,801. December 11th.

Electric Regulating or Equalising Apparatus. R. Rankin and Chloride Electrical Storage Co. 28,913. December 22nd.